Department of the Air Force

FINAL ENVIRONMENTAL PLANNING TECHNICAL REPORT

CULTURAL AND PALEONTOLOGICAL RESOURCES

January 1984

Air Force
Environmental Planning Division
(HQ USAF/CEVP)

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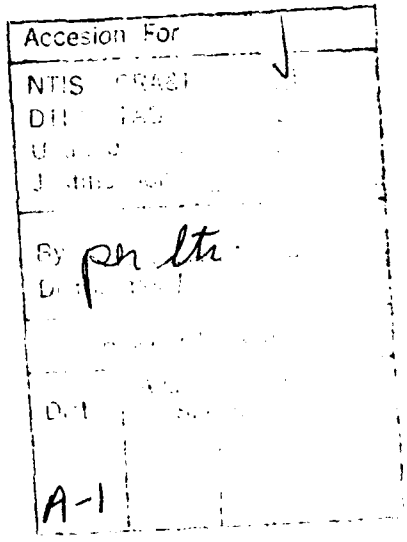

PREFACE

The President has directed that the Air Force deploy the Peacekeeper missile system at a location near F.E. Warren Air Force Base (hereafter F.E. Warren AFB), close to Cheyenne, Wyoming. The Peacekeeper system (formerly known as the M-X system) is an advanced, land-based intercontinental ballistic missile. The plan calls for the replacement of 100 existing Minuteman III missiles with 100 Peacekeeper missiles. Existing missile silos will be used, and there will be very little structural modification needed. Missile replacement will occur within the two squadrons (of 50 missiles each) located nearest F.E. Warren AFB, the 319th and 400th Strategic Missile Squadrons. Peacekeeper deployment will occur between 1984 and 1989.

An environmental impact statement (EIS) was prepared for the Proposed Action as outlined above. Information contained in the EIS is based upon environmental information and analysis developed and reported in a series of 13 final environmental planning technical reports (EPTRs). This volume is one of those reports. The 13 resource areas are:

- Socioeconomics (employment demand, housing, public finance, construction resources, and social well-being);
- Public Services and Facilities;
- Utilities;
- Energy Resources;
- Transportation;
- Land Use (land use, recreation, and visual resources);
- Cultural and Paleontological Resources;
- Water Resources;
- Biological Resources;
- Geologic Resources;
- Noise;
- Air Quality;
- Jurisdictional.

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INTRODUCTION

1.0 INTRODUCTION

This final environmental planning technical report (EPTR) is a companion document to the cultural and paleontological resources sections of the final environmental impact statement (FEIS) for the Peacekeeper in Minuteman Silos project. It provides data, methodologies, and analyses which supplement and extend those presented in the FEIS.

This final EPTR consists of six major sections. Section 1.0 provides an overview of the Peacekeeper in Minuteman Silos project and a description of the cultural and paleontological resources and their elements.

Section 2.0 presents a detailed description of the environment potentially affected by the project. It includes a capsule description of the environmental setting (Section 2.1) and project requirements (Section 2.2). Section 2.3 defines the Region of Influence and Area of Concentrated Study for the resource. Section 2.4 (Derivation of Data Base) follows with a discussion of the literature sources, group and agency contacts, and primary data which provide the data base for the report. Section 2.5 describes analytic methods used to determine existing environmental conditions in the Region of Influence. Detailed analyses of the existing environment, broken down by constituent elements of the resource, follow in Section 2.6.

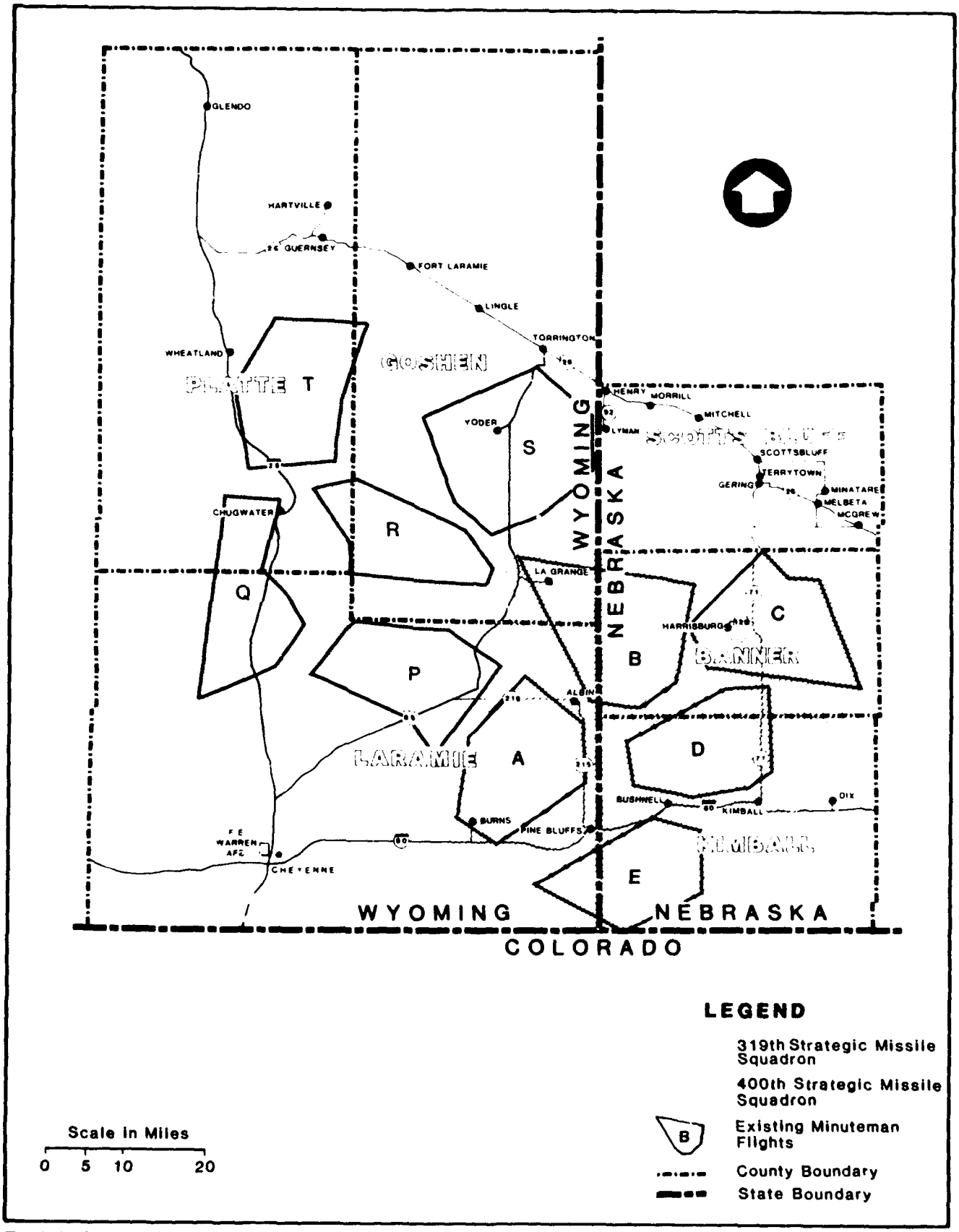
Section 3.0 describes environmental consequences of the Proposed Action and its project element alternatives, the No Action Alternative, mitigation measures, and unavoidable impacts. It contains detailed definitions of each potential level of impact (negligible, low, moderate, and high) for both short-term and long-term impacts. Beneficial effects are also discussed. Definitions of significance are also included. Methods used for analyzing future baseline and project impacts are described, as are assumptions and assumed mitigations. Additional mitigation measures to reduce project impacts are also described.

Sections 4.0 (Glossary), 5.0 (References), and 6.0 (List of Preparers) conclude the EPTR.

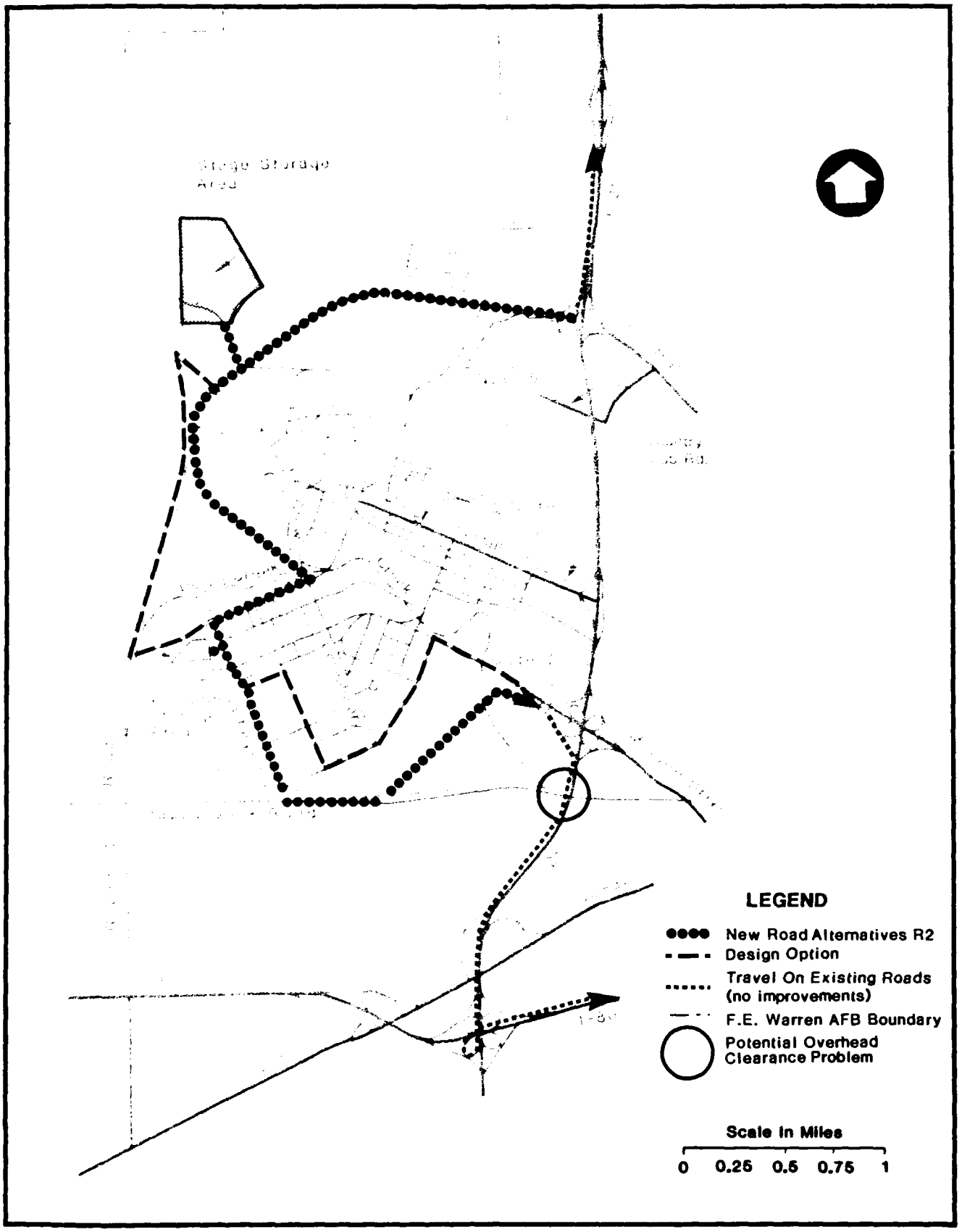
1.1 Peacekeeper in Minuteman Silos

The Peacekeeper system, which the Air Force plans to deploy within the 90th Strategic Missile Wing at F.E. Warren Air Force Base (AFB), Wyoming, is an advanced land-based intercontinental ballistic missile system designed to improve the nation's strategic deterrent force. Deployment of the Peacekeeper calls for replacement of 100 existing Minuteman III missiles with 100 Peacekeeper missiles. Missile replacement will occur in the 319th and 400th Strategic Missile Squadrons, located nearest F.E. Warren AFB (Figure 1.1-1). The Deployment Area covers parts of southeastern Wyoming and the southwestern Nebraska Panhandle.

Construction at F.E. Warren AFB will occur between 1984 and 1986. Fourteen new buildings will be constructed, and modifications or additions will be made to 11 existing buildings. Approximately 400,000 square feet of floor space will be built or modified. A new road configuration, to be selected from three alternatives, is proposed to link Peacekeeper facilities onbase and to provide improved access to or from the base (Figures 1.1-2, 1.1-3, and 1.1-4).

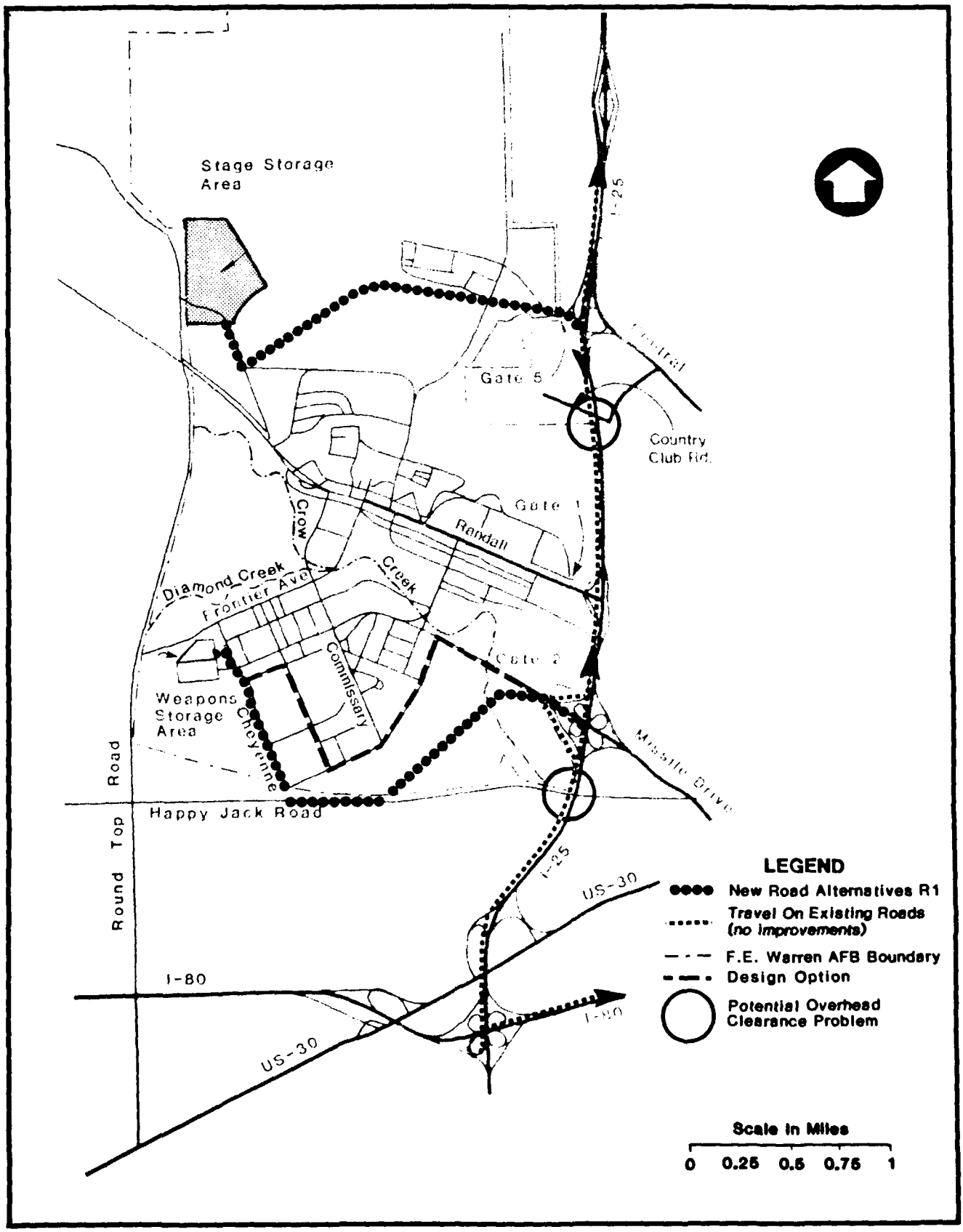


PEACEKEEPER DEPLOYMENT AREA FIGURE NO. 1.1-1



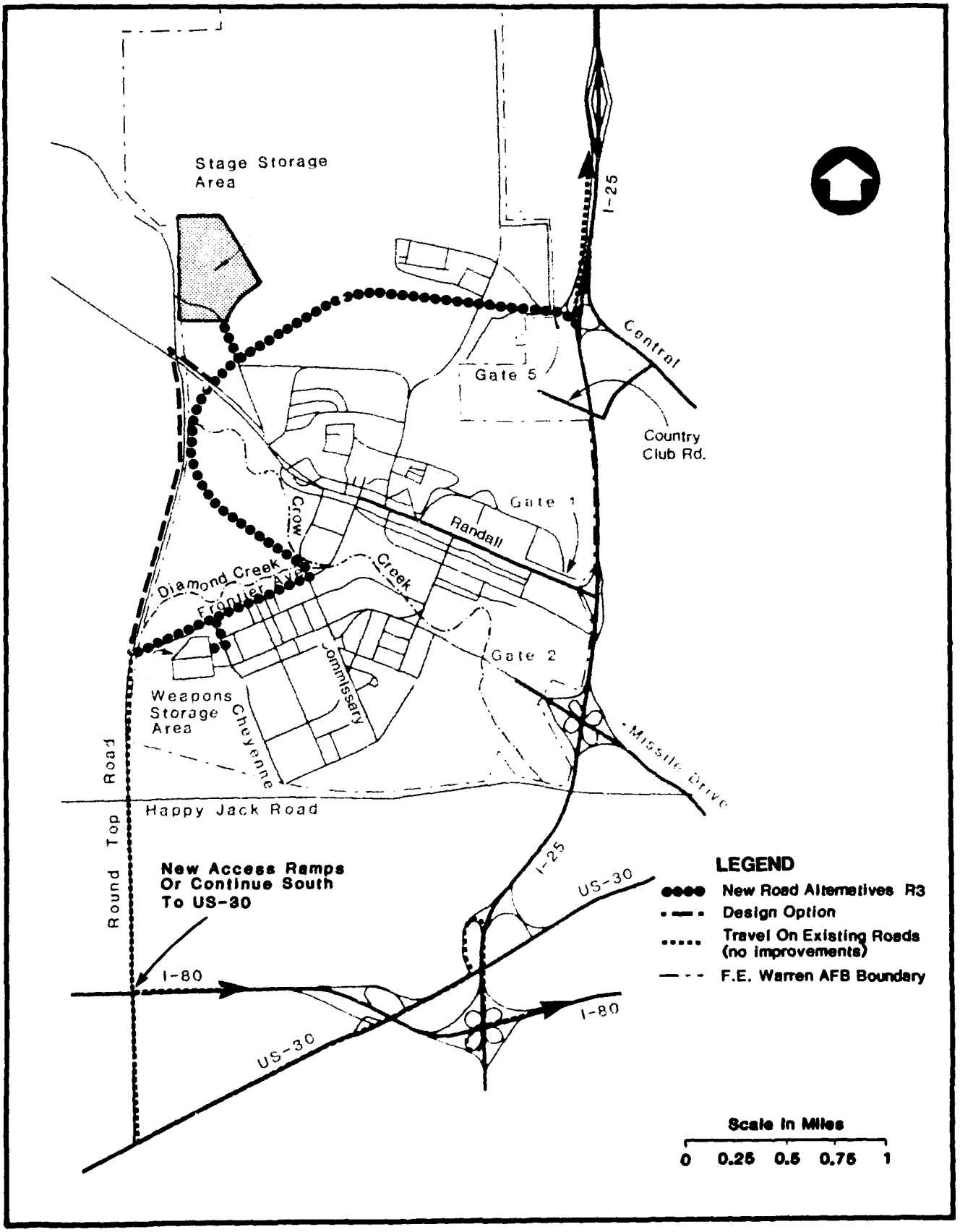
NEW ROADS AT F.E. WARREN AFB: PROPOSED ACTION R2

FIGURE NO. 1.1-2



NEW ROADS AT F.E. WARREN AFB: ALTERNATIVE R1

FIGURE NO. 1.1-3



NEW ROADS AT F.E. WARREN AFB: ALTERNATIVE: R3

FIGURE NO. 1.1-4

Work in the Deployment Area will take place between 1985 and 1989. Many of the access roads to the Launch Facilities will be upgraded. Bridge clearance problems will be corrected, and some culverts and bridges may need to be upgraded. Below-ground modifications will be related to removal of Minuteman support hardware, insertion of a protective canister to enclose the Peacekeeper, and installation of communications systems and support equipment.

A total of 11 alternatives have been chosen as candidate routes for communication connectivity between Squadrons 319 and 400 (Figure 1.1-5). Five routes will be selected for installation. Total buried cable length will range from approximately 82 to 110 miles, depending upon final route selections.

Under the Proposed Action two dispatch stations would be established, one each in the northern and eastern portions of the Deployment Area. Although actual locations have not been selected, Chugwater, Wyoming and Kimball, Nebraska are representative locations analyzed in the Final Environmental Impact Statement and in this EPTR. Dispatch stations would be not more than 5 acres in size and would be used for the temporary open storage of equipment and material. One or more buildings would also be present at each site for contractor use as office space. All dispatch stations would be removed prior to project completion. In addition to the Proposed Action, two alternatives are considered in this environmental impact assessment:

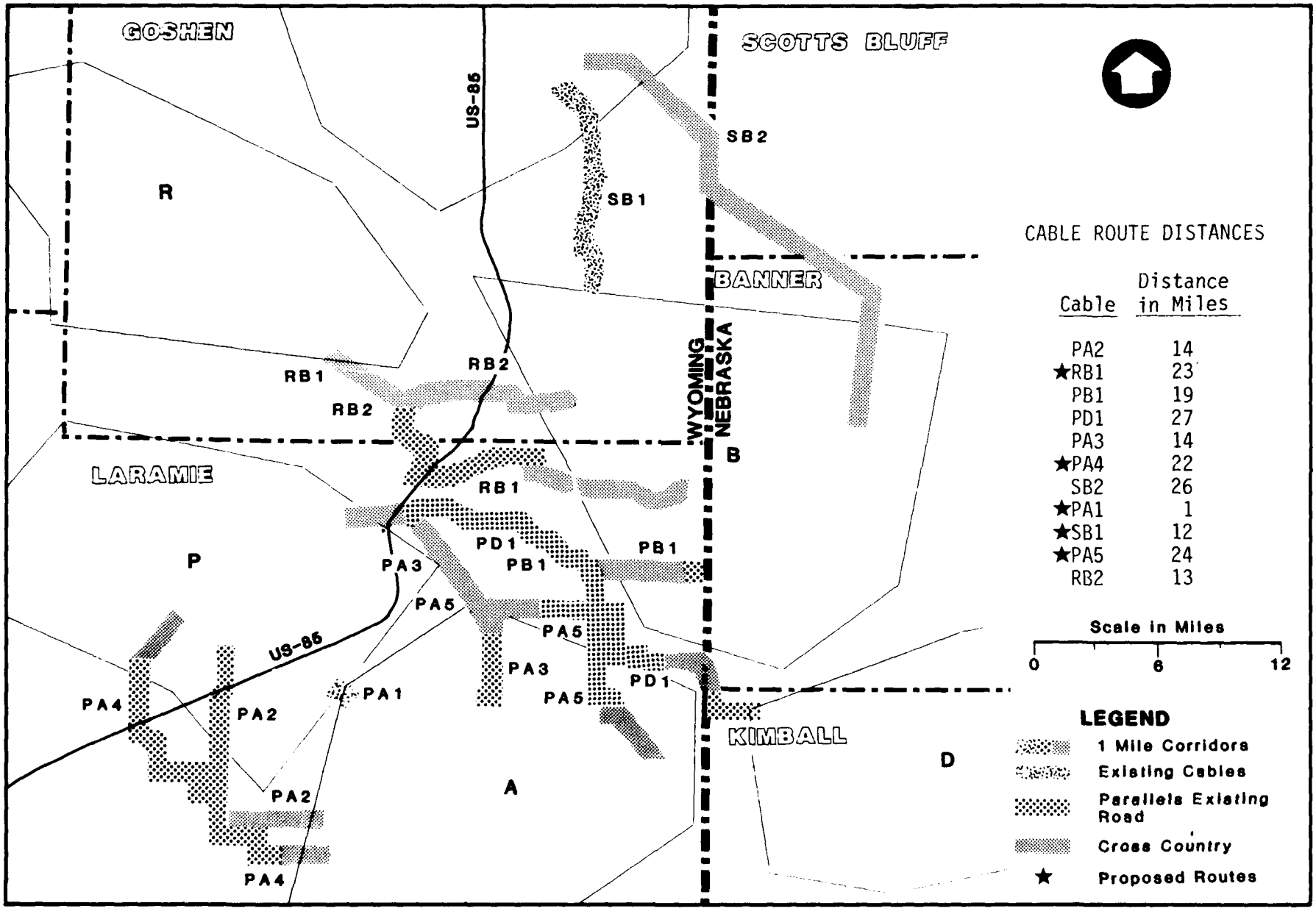
1) One dispatch station only, in the eastern part of the Deployment Area; or

2) No dispatch stations.

Two options have been identified for resurfacing Deployment Area roads. Surfacing Option A involves gravel upgrades of 252 miles of existing gravel roads and the paving or repaving of 390 additional miles of gravel and asphalt roads. Surfacing Option B involves the paving or repaving of all 642 miles of gravel and asphalt roads listed in Surfacing Option A.

Direct manpower for construction, assembly and checkout, and operation of the system will peak during 1986 when an average of nearly 1,600 persons will be required. In 1991, following deployment, the remaining increased operational workforce at F.E. Warren AFB will consist of about 475 persons. Table 1.1-1 presents the average annual workforce, based on quarterly estimates for each year of construction.

Table 1.1-2 shows the average number of jobs including those which are considered to be filled by available labor; as well as those filled by weekly commuters and inmigrants, on an annual average basis. In general, locally available labor will fill all the road and construction jobs.



ALTERNATIVE CABLE ROUTES

FIGURE 1.1-5

Table 1.1-1

PROJECT AVERAGE MANPOWER REQUIREMENTS BY YEAR[1]

	1984	1985	1986	1987	1988	1989	1990	1991
Deployment Area								
Construction	5	40	60	60	40	0	0	0
Assembly and Checkout	0	15	210	285	265	265	10	0
Operations	0	0	0	0	0	0	0	0
Defense Access Road	0	275	315	150	0	0	0	0
Subtotal	5	330	585	495	305	265	10	0
Operating Base								
Construction	100	630	70	0	0	0	0	0
Assembly and Checkout	40	130	525	555	515	510	22	0
Operations	0	130	415	490	500	500	475	475
Subtotal	140	890	1,010	1,045	1,015	1,010	497	475
TOTAL:	145	1,220	1,595	1,540	1,320	1,275	507	475

Note: [1] Estimates based on average quarterly employment.

Table 1.1-2

TOTAL JOBS, LOCAL AND REGIONAL HIRES, AND INMIGRATION FOR THE EMPLOYMENT DEMAND REGION OF INFLUENCE

	1984	1985	1986	1987	1988	1989	1990	1991 and beyond
1) Total (Direct/ Indirect) Additional Jobs	250	2,400	2,675	2,550	2,025	1,825	650	590
2) Average Annual Local Hires	157	1,750	1,525	1,350	1,100	815	225	230
3) Average Annual Weekly Commuters	25	225	175	100	25	10	0	0
4) Average Annual Inmigrant Workers	75	425	950	1,100	925	1,000	425	360
5) Unsuccessful Job-Seekers	30	185	180	150	165	110	70	0
6) Inmigrant[1] Population	275	1,475	2,875	3,200	3,025	2,875	1,200	925

Note: [1] Includes inmigrants, workers, and unsuccessful job-seekers.

As a result of the purchase of materials in the project area and the local expenditures of project employees, additional jobs will be created in the region. These jobs are estimated to number as follows:

Year:	1984	1985	1986	1987	1988	1989	1990	1991 & on
Indirect Jobs:	105	1,180	1,080	1,010	705	550	143	115

Estimated materials and costs for the project, based on total project budgetary considerations, are shown by Standard Industrial Classification in Table 1.1-3.

A number of construction and support materials will be obtained from sources within the project area. Among the materials exerting a major influence on assessment of project impacts are aggregate (4.6 million tons), water (516 acre-feet), fuel (7.6 million gallons), and electricity (3.8 million kWh). In the case of water supply for construction, the Air Force will identify and, if necessary, obtain permits for the water or purchase existing water rights.

1.2 Description of Resources

As used in this report, the term cultural and paleontological resources includes four major elements: prehistoric cultural resources, historic cultural resources, American Indian resources, and paleontological resources. These divisions recognize inherent differences among the elements both in their physical manifestations and in the kinds of treatment and protection afforded to each under existing statutes, regulations, and guidelines.

Prehistoric cultural resources consist of those physical properties predating the advent of written records in a particular geographic region that are considered important to a culture, subculture, or community for scientific or humanistic reasons. These include geographical districts, structures, sites, objects, and other physical evidence of past human activity.

Historic cultural resources consist of those physical properties postdating the advent of written records in a given region that are considered important to a culture, subculture, or community for scientific or humanistic reasons. These include districts, structures, sites, objects, documents, and other physical evidence of past human activity.

American Indian cultural resources consist of locations, structures, biota, objects, and natural features of value to contemporary American Indians for traditional, religious, or ceremonial purposes. These resources include American Indian burials; contemporary sacred sites and areas; materials for production of sacred objects and traditional implements; and botanical, biological, and geological resources of ritual importance and their source locations..

Table 1.1-3

ESTIMATED MATERIAL REQUIREMENTS
BY STANDARD INDUSTRIAL CLASSIFICATION

Industrial Classification		Estimated 1982 Dollars (1,000s)
Fabricated Structural Metal		$22,999
Unclassified Professional Services and Products		14,358
Cement and Concrete Products		10,862
General Wholesale Trade		8,890
Structural Metal Products[1]	11,983	
Millwork, Plywood, and Wood Products[1]		3,941
Copper, Copper Products		3,902
Electrical Lighting and Wiring		3,871
Stone and Clay Mining and Quarrying		39,728
Stone and Clay Products[1]		2,955
Basic Steel Products		1,233
Heating and Air Conditioning Apparatus		1,525
Plumbing and Plumbing Fixtures		938
Petroleum Refining and Products		5,148
Material Handling Equipment		1,970
Sawmills and Planing Mills		1,478
Paints and Allied Products		1,478
Plastic Products[1]		1,478
Furniture and Fixtures		986
Structural Clay Products		986
General Hardware		986
Scientific Instruments		986
Rail Transport		986
Real Estate		986
Construction, Mining, and Oilfield Machinery		749
TOTAL:		$145,402

Note: [1] Not included in other Industrial Classifications.

Paleontological resources consist of physical remains of extinct life forms or others that may still have living representatives. These include fossilized remains of animals or plants or parts thereof, casts or molds of the same, or trace fossils such as impressions, burrows, and tracks. These typically occur in such contexts or localities as surface exposures, subsurface deposits exposed by ground-disturbing activities, and sites affording special environments for preservation (e.g., caves, peat bogs, and tar pits).

2.0

AFFECTED ENVIRONMENT

2.0 AFFECTED ENVIRONMENT

2.1 General

The area in which the Proposed Action will occur is rich in resources exemplifying its biological and cultural heritage. Geologic deposits containing plant and animal remains spanning the past 60 to 170 million years or more are represented at localities throughout the Region of Influence (ROI), and some (e.g., Scotts Bluff, Como Bluff) have received national recognition for the fossil remains recovered from them.

Traces of human existence span the last 10,000 to 12,000 years before the present (BP), and important sites in the region bear witness to the development of man's culture from the end of the Ice Age to the present. As a segment of the Great Plains, the ROI was inhabited formerly by groups of American Indians such as the Sioux, Cheyenne, and Arapaho. With the influx of Euramerican populations, construction of railroads, military installations (e.g., Fort D.A. Russell, the forerunner of today's F.E. Warren AFB), homesteads, and urban communities gave the region its present character.

Major traces of the area's past exist today as paleontological, archaeological, and architectural remains that can be found in both rural and urban contexts. In particular, F.E. Warren AFB itself contains an abundance of important prehistoric and historic properties extending over a 4,000 to 5,000 year period. The importance of some of these resources has been recognized nationally with the establishment of a National Historic Landmark onbase to protect and preserve historically and stylistically important structures representing major phases of the installation's development from a frontier cavalry post to a key Air Force facility. Although scientifically and humanistically valuable resources are known or expected to exist throughout the ROI, F.E. Warren AFB will be a major focus of current and future studies.

The sections that follow provide descriptions of the project requirements (Section 2.2), the region in which the effects of the Proposed Action will occur (Section 2.3), the sources of data used to characterize potential effects (Section 2.4), and the methods employed to analyze data relating to affected areas (Section 2.5). Section 2.6 presents a general discussion of the physical environment of the region, an overview of the general classes of resources and temporal/cultural divisions, a description of known resources as identified by prior and ongoing research, and a categorization of expected resources.

Completion of the environmental planning technical report (EPTR) for cultural and paleontological resources is the first step in the establishment and implementation of a comprehensive resources management program, the objectives of which are to ensure consideration of these resources in project facilities planning and construction design and to provide measures necessary for resource preservation, protection, or recovery. This document serves as an overview, within the context of the Proposed Action, of those cultural and paleontological resources recorded to date, both onbase and throughout the ROI, and as a description of the historic and scientific contexts in which these resources may make important contributions. This overview is intended to identify current baseline conditions for each resource and its elements in

order to predict the extent of anticipated changes, if any, that may result from project deployment and operation (Section 3.0).

2.2 Project Requirements

Overall project requirements have already been outlined in Section 1.1. In addition to those needs, however, the Proposed Action entails certain requirements specific to cultural and paleontological resources.

In particular, proposed modifications or additions to existing onbase structures will require changes in the interior or exterior fabric of several structures. Most of these buildings are located within the current boundaries of the F.E. Warren AFB Historic District/National Landmark and are protected under various federal statutes and regulations.

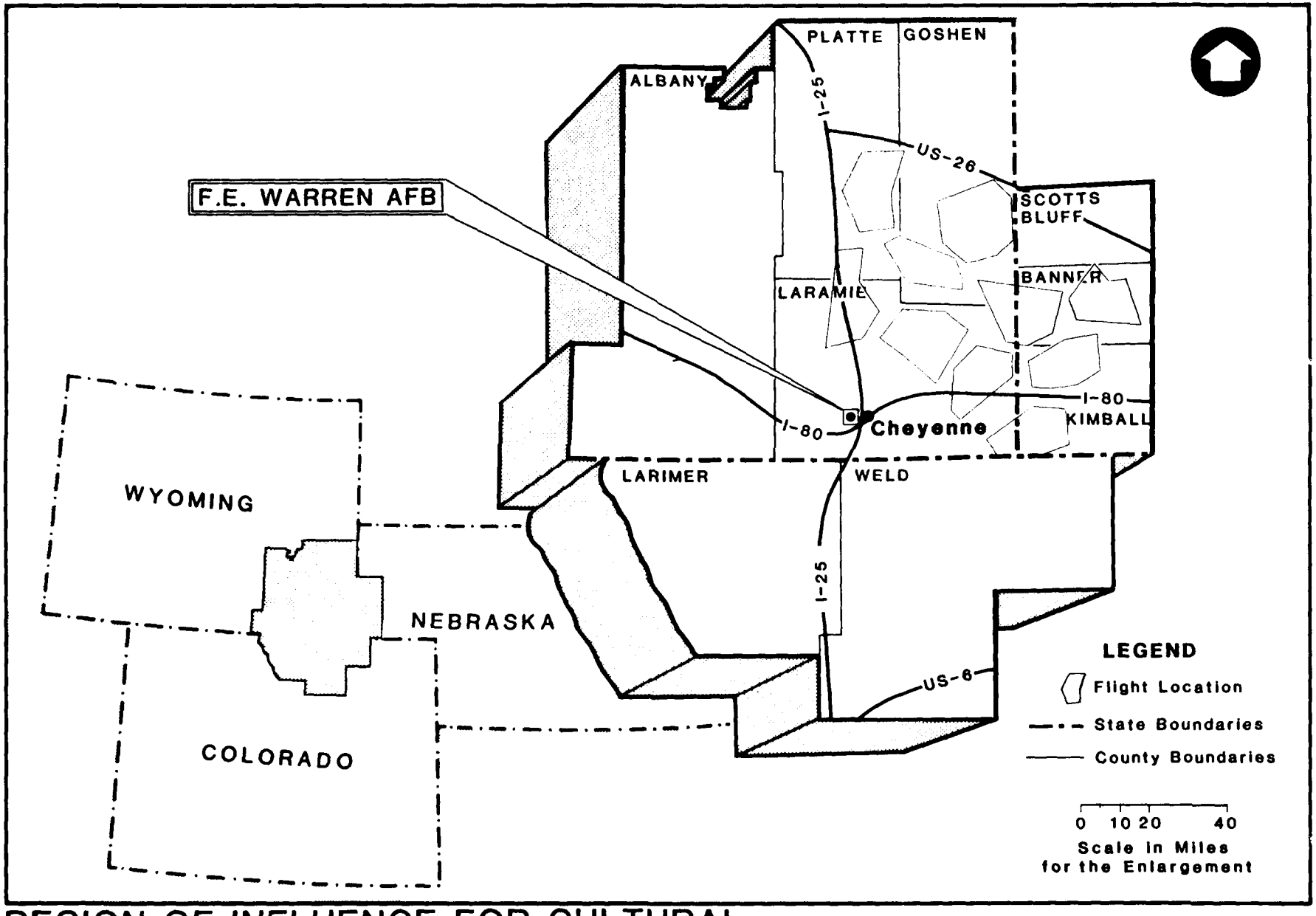
In addition, construction and deployment of the proposed system will involve considerable amounts of ground disturbance (e.g., road construction and upgrade, communications cable emplacement, utilities construction) that could require alteration or destruction of cultural and paleontological resources. The nature, extent, and potential significance of these impacts are the focus of this assessment.

2.3 Region of Influence

The ROI for cultural and paleontological resources encompasses Albany, Goshen, Laramie, and Platte counties in Wyoming; Banner, Kimball, and Scotts Bluff counties in Nebraska; and Larimer and Weld counties in Colorado (Figure 2.3-1). Delineation of this area is based on analysis of the kinds and locations of impacts anticipated as a consequence of project construction and operation. In addition to direct, localized, ground-disturbing effects occurring during project construction, which will be controlled by project facilities siting decisions, the ROI encompasses sufficient geographic space to ensure that potentially significant indirect, population-induced effects (e.g., altered land use and recreational patterns) are included within its boundaries. The identification of areas potentially subject to measurable population growth and related effects is based on population allocation models generated by the socioeconomics task group.

An Area of Concentrated Study (ACS) requiring more detailed analyses of project impacts was recognized within the ROI. The ACS consists of a mosaic of relatively small, localized areas (e.g., the Launch Facilities and the Operating Base) and corridors (e.g., transportation and communications rights-of-way) where direct, project-related ground disturbances may take place. These areas are contained within Goshen, Laramie, and Platte counties in Wyoming and Banner, Kimball, and Scotts Bluff counties in Nebraska.

The recognition of a separate ACS and ROI is tied to the kinds and locations of impacts expected as a consequence of project implementation: the ROI encompasses those resources subject to indirect project effects, and the ACS includes resources subject to direct effects. Given that direct effects will be the focus of active advance mitigation measures on the part of the Air Force, whereas indirect effects cannot be attributed to specific resources in advance, the maintenance of a difference between the two study areas has both analytical and managerial justification, and further discussion of these differences is included in Section 3.1.



REGION OF INFLUENCE FOR CULTURAL AND PALEONTOLOGICAL RESOURCES

FIGURE NO. 2.3-1

2.4 Derivation of Data Base

Information necessary for the assessment of existing conditions, potential impacts, and future trends relating to cultural and paleontological resources occurring within the ROI and ACS comes from a multitude of primary and secondary sources. In the sections that follow, summaries are presented of the types and locations of information included within the current data base.

2.4.1 Secondary Data Sources

As used in this study, the term secondary data refers to those categories of information that are not the product of direct experience. In this particular instance, the sources for such information are written and oral narratives.

The most important source of secondary data for all resource elements is the written record. Over 1,000 individual documents were reviewed during the course of this study, including statewide inventories, histories, reports of explorations, newspaper articles, ethnographies, scientific treatises, archaeological site reports, and similar documents requiring access to numerous libraries, archives, and repositories. A partial list of these facilities includes the Wyoming, Nebraska, and Colorado State Historic Preservation Offices (SHPOs); the Wyoming Division of Archives and History in Cheyenne; the Nebraska State Historical Society Archives in Lincoln; the Denver Public Library; the Coe Library at the University of Wyoming in Laramie; the University of Denver Library; the American Museum of Natural History in New York; the Peabody Museum at Yale University; the U.S. National Museum in Washington DC; and the museums at the universities of Wyoming, Nebraska, and Colorado.

Perhaps the single most important data source among those listed above is the site inventory records and reports held by the SHPOs. Information contained within their files, which includes county-by-county listings and descriptions of all known cultural resources, provides the basis for establishing current baseline characterizations and for assessing future trends in the resource both with and without the project.

Interviews were conducted with knowledgeable professionals in both the academic and private sectors, amateur archaeologists and historians, and local landholders as a means of identifying possible resource localities not included in statewide inventories or other published sources. Contact also was made with several individuals at F.E. Warren AFB, including the Base Civil Engineer, Base Real Property Officer, Base Historic Preservation Officer, and Base Historian, in order to collect information about the history of past military activity at this important historical facility. Personal interviews were conducted with members of Indian groups having historical ties to the ROI to identify sites of potential concern to contemporary practice of traditional religions and cultural activities. Several paleontologists having ongoing professional research interests in the ROI were contacted to identify known and potential fossil localities in the area.

2.4.2 Primary Data Sources

Primary data consist of those categories of information obtained as a consequence of direct experience. In the case of the current analysis, such information was gathered through onsite examination of selected areas within the ACS in order to inventory and evaluate cultural and paleontological resources subject to project impacts. These field investigations had three distinct foci: 1) historic architectural resources at F.E. Warren AFB, 2) archaeological resources at F.E. Warren AFB, and 3) archaeological and architectural resources in other areas of the project Deployment Area (DA) potentially subject to ground-disturbing activities.

Systematic onsite inventory and description of all standing structures located within the F.E. Warren AFB Historic District/National Landmark, as well as select onbase structures outside the District/Landmark's boundaries, were undertaken to assess existing conditions and to make recommendations regarding adaptive reuse of structures for project missions. These investigations included exterior documentation and descriptions of nearly 300 individual structures, interior documentation and descriptions of 44 structures, and an examination of historic landscaping.

Systematic pedestrian surface reconnaissance was used to inventory archaeological and paleontological resources located within a series of proposed rights-of-way for onbase stage transporter (S/T) routes. Similar inventory measures were used to examine the proposed Stage Storage Ar a (SSA) and Weapons Storage Area (WSA) facilities. As a consequence of these inventory efforts, 63 previously unrecorded loci of historic and prehistoric cultural remains were discovered. These included 25 instances of isolated artifacts and 38 loci containing multiple artifacts that have been given site designations. Follow-on resource evaluation measures were undertaken at several of the sites. These efforts included: 1) systematic surface collection to recover a representative sample of horizontal variability across a site; 2) shovel testing to establish the horizontal and vertical limits of the cultural deposits; and 3) limited-scale subsurface test excavation to establish preliminary estimates of stratigraphic and temporal variability at selected sites.

Systematic pedestrian reconnaissance and visual assessment measures were used to inventory archaeological and architectural resources in select portions of the DA. Surface reconnaissance techniques were employed around the perimeter fence at each of the 100 proposed project launch Facilities (LFs). A visual inventory of historical structures in need of follow-on investigation was conducted along all Defense Access Roads (DARs) and within the Quantity Distance (QD) radius at all LFs. As a consequence of these investigations, only one prehistoric site and approximately 30 structures were located in areas potentially subject to project impacts.

2.5 Analytic Methods for Existing Conditions

Analysis of information gained from literature research, personal interviews, and onsite inventory and evaluation were undertaken to establish baseline existing conditions and to identify biases in the record that could affect later synthesis and interpretation. To a large degree, data processing and manipulation were similar for all constituent elements of the resource. All

known sites and localities were first plotted onto standard topographic maps to provide a common basis from which to assess resource dispersions. Records and reports pertaining to prehistoric cultural sites were reviewed to extract information about ages and types of sites, their geographic location, and surrounding environments. These data were keyed into a computer and the resultant data base used to develop summary accounts of existing conditions within the ROI and to generate qualitative estimates of resources potentially subject to project impacts.

Information currently available from statewide inventories and published accounts is vitally important to an understanding and appreciation of the region's cultural and paleontological record. Existing inventories, however, are the cumulative sum of more than 50 years of prior research in this area and thereby incorporate historical bias in the level of detail reported for any particular locality. In addition, each state has its own unique recording system. Nevertheless, for the overwhelming majority of recorded sites, relatively consistent data are available specifying geographic location and site type. In the case of prehistoric resources, the latter data category typically consists of a general descriptive term denoting resource context (e.g., rockshelter), structure (e.g., tipi ring), content (e.g., lithic scatter), or function (e.g., campsite or kill site). In the case of historic cultural resources, the existing state inventories generally indicate whether a site is architectural or archaeological in nature but typically do not give finer distinctions. Paleontological localities have not been recorded consistently on statewide inventories, and information about these resources must be drawn from other sources.

In addition to using information extracted from secondary data sources, the current characterization of baseline resource conditions incorporates data gathered from primary onsite investigations of areas subject to direct impacts (Section 2.4.2). This includes both architectural and archaeological sources.

For architectural resources (specifically, standing historic structures at F.E. Warren AFB), the data consist of exterior descriptions and photographic documentation of all onbase structures possessing potential historic merit, as well as interior documentation of all structures subject to potential project-related modifications. Information concerning specific proposed project elements was compared to the baseline data in order to assess the degree to which individual structures would be altered by project-induced adaptive reuse. In addition to using these assessments in the current analysis, information developed as a consequence of these studies will be used in the facilities design process in an effort to minimize potential impacts to important historic structures.

Data recovered as a consequence of onsite archaeological inventory and evaluation of areas subject to direct project impacts consist of artifacts, contextual samples (e.g., soil and charcoal), and field records describing the conduct and progress of all investigations. Analyses of artifactual samples recovered from surface collections and subsurface testing are aimed at characterizing the functional, technological, and stylistic variability manifest in a given site assemblage. This information is crucial in determining a site's place in the indigenous cultural system and in assessing site importance. Similarly, analyses of contextual samples recovered during onsite investigations are necessary to help establish the character of the

depositional environment and its impact on cultural remains. Radiocarbon dating of charcoal samples extracted from a site's deposits provides essential information about the potential time-depth of site occupation or use. The results of these investigations were integrated into the current assessment effort to determine the nature and degree of impacts potentially resulting from the Proposed Action.

As noted above, analyses of records and samples collected during onsite architectural and archaeological field investigations have yet to be completed. This effort is currently ongoing and will provide the basis for determinations of site eligibility for listing in the National Register of Historic Places (NRHP) and the need for further management consideration. Once analyses are completed, information will be assembled into a series of reports that will detail the design, conduct, and results of all studies. These reports will be made available to cognizant review agencies and interested professionals and will provide supporting details to conclusions and recommendations presented here.

2.6 Existing Environmental Conditions

2.6.1 Environmental Overview

It has long been recognized that the adaptive strategies of human societies are affected by the environment in which they live. For example, the dynamics of a changing environment, and thus resource availability, require adjustments in the subsistence and settlement patterns of resident groups, particularly hunting and gathering societies. During the period of human occupation on the Northwest and Central Plains, environmental conditions have varied considerably. Pleistocene glaciation and Holocene fluctuations in temperature and precipitation had pronounced effects on the composition and distribution of resources used by both prehistoric and historic societies. Consequently, an understanding of environmental dynamics is a prerequisite to explaining the physical cultural record of human occupation and use of the region.

Recently, increased awareness has developed of the nonstatic nature of materials, both cultural and paleontological, that are deposited at individual resource localities. Subsequent to their initial deposition, all material remains are subjected to environmental processes that act to alter or destroy both physical integrity and contextual relationships. Such "formation processes" (Schiffer 1976) encompass a broad range of natural and cultural forces. Natural transformation factors include chemical and physical weathering, surface erosion, and soil development. Equally important are human activities that modify the terrain such as scarifying, plowing, and landscaping. Consequently, in order to understand the "message" contained within the data at a particular locality, it must be filtered from the background "noise" that is due to such formation processes.

In the paragraphs that follow, consideration is given to the environment of the region and to the processes that may have affected the formation and condition of the existing cultural and paleontological resource inventories.

2.6.1.1 Physiography

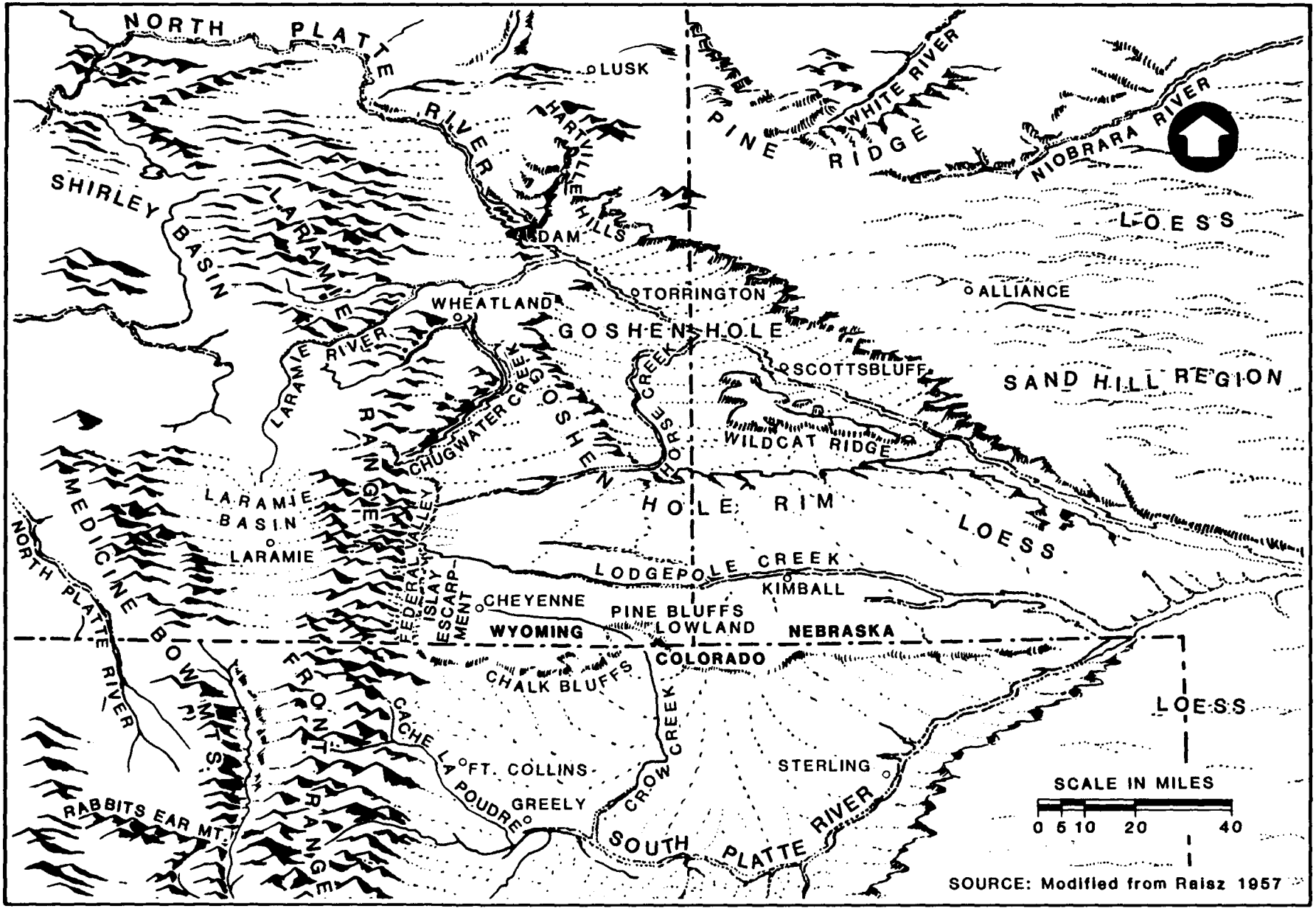
The majority of the ROI lies in the High Plains section of the Great Plains Physiographic Province (Figure 2.6.1-1). The elevation of the High Plains surface is over 7,000 feet (2,100 meters) adjacent to the Laramie Mountains, and the surface slopes to the east with a gradient of 20 to 100 feet per mile (ft/mi) (3.8 to 18.8 meters per kilometer). The western portion of the ROI, which includes the Laramie Mountains and extends from near Casper, Wyoming to the Front Range in Colorado, lies in the Southern Rocky Mountains Physiographic Province. The Laramie Mountains and Colorado Front Range vary from 8,000 to over 12,000 feet (2,400 to 3,600 meters) in elevation and are locally broken by steep-sided valleys and rugged peaks. Another important mountain range within the ROI, the Hartville Hills, rises to elevations of more than 6,000 feet (1,825 meters) in northeast Platte County.

Several escarpments and lowlands (Figure 2.6.1-1) in the ROI are important topographic elements that influence the distribution of cultural resources. The Goshen Hole Lowland, a great erosional widening of the North Platte River valley, is located in Platte and Goshen counties. Escarpments with over 200 feet (60 meters) of relief discontinuously surround these lowlands (Libra et al. 1981). A similar physiographic feature, the Pine Bluffs Lowland, is found in southeast Laramie County and extends into adjoining counties in Colorado and Nebraska. The east side of the lowlands is bounded by the Pine Bluffs Escarpment, a west-facing feature trending north-south in Wyoming and northeast-southwest in Nebraska that rises some 200 feet (60 meters) above the adjacent lowlands. In places the west side of the lowlands is marked by a lower, less pronounced eastward-facing escarpment locally referred to as the Chalk Hills. Between the Laramie Mountains and the High Plains surface lies Federal Valley. This valley is 3 to 8 miles (5 to 13 kilometers) wide and is bounded on the west by the Laramie Mountains and on the east by the Islay Escarpment. The latter feature rises 250 feet (75 meters) above the valley floor before gently sloping eastward onto the High Plains surface.

Badlands topography is developed in several areas of the ROI. One major occurrence is both east and west of Scotts Bluff along the upper reaches of the North Platte River and has two westerly extensions into the Goshen Hole. A second badlands area occurs on the south side of Wildcat Ridge along Pumpkin Creek, and a third area is developed in the vicinity of Sidney along Lodgepole Creek and south of Sidney near New Rayner and Akron, Colorado.

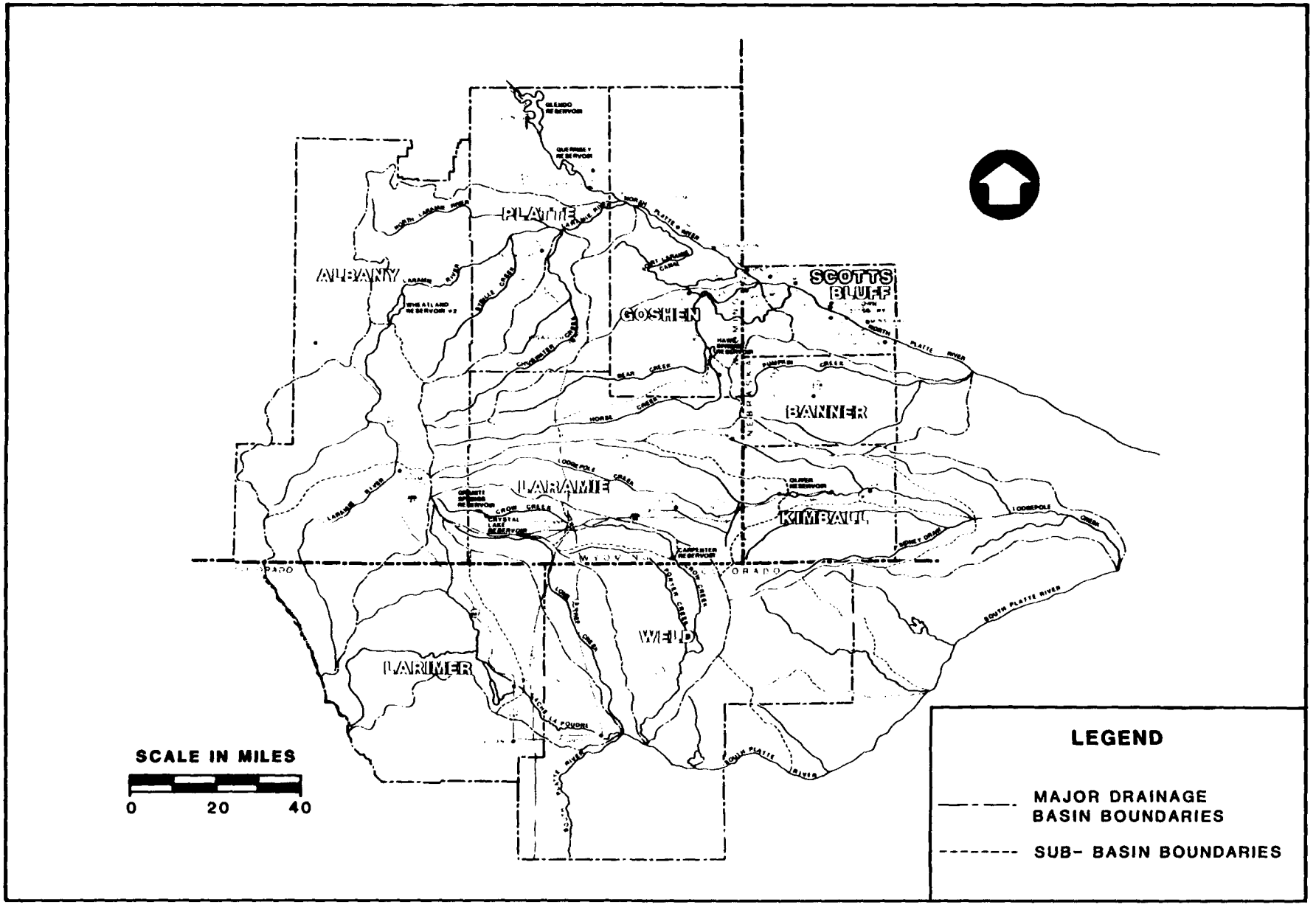
The North and South Platte rivers are the major perennial drainages within the ROI (Figure 2.6.1-2). Perennial tributaries to these rivers include the Laramie River; Chugwater, Rawhide, and Horse creeks; and Cache La Poudre. Crow, Lodgepole, and Pumpkin creeks currently are intermittent, gaining water from the groundwater system along some reaches and losing water along others. Drainage networks within the ROI are highly variable, ranging from intricate dendritic patterns in mountainous terrain to subparallel or parallel systems in the central and eastern portions of the High Plains surface.

The locations and character of topographic and hydrologic features are of particular importance for understanding the cultural and paleontological record. Regional and local topography and hydrology influence not only group mobility and the availability of critical subsistence resources but also field recognition of physical remains that are subject to cultural and



PHYSIOGRAPHY OF THE PROJECT AREA

FIGURE NO. 2.6.1-1



MAJOR DRAINAGE SYSTEMS IN THE ROI

FIGURE NO. 2.6.1-2

paleontological inquiry. While the former is of obvious direct research interest, the latter represents a potential bias that may profoundly alter the value of research findings and thus should be taken into account at all phases of investigation. For example, given that vertical exposures increase the amount of surface available for inspection within a given area and also tend to have less ground cover, inventory of eroded or dissected areas could be expected to result in the discovery of a greater proportion of the total resource population. Consequently, interpretations of the physical record that involve resource density or dispersion should be tempered with a consideration of the potential effects of this bias.

2.6.1.2 Soil

Most of the soil data for the ROI are available from the U.S. Soil Conservation Service (SCS). Modern soil surveys have been completed for five of the nine counties in the ROI. The major soil orders within the ROI include Entisols, Aridisols, Mollisols, and Alfisols. Table 2.6.1-1 gives the general characteristics of each order. A more complete discussion of the characteristics of these soil orders and of soil taxonomy in general is provided in U.S. Department of Agriculture (USDA) Handbook No. 436 (1975).

Two soils characteristics are particularly important to the preservation of prehistoric cultural sites. Soil acidity/alkalinity will determine, in part, how well bone, pollen, or other organic materials will be preserved. Certain soil conditions enhance preservation of carbonaceous materials used in radiocarbon dating while other conditions affect the preservation of pollen, which provide data on paleoclimatic conditions that may have affected the lifeways of resident cultural groups.

The geologic medium (e.g., alluvium, eolian sand, exposed bedrock) in which archaeological deposits occur and the landscape position of a resource are important considerations when assessing potential site disturbance. For example, archaeological sites located on the open plains are less likely to have been disturbed by geologic processes than sites located on low alluvial terraces adjacent to perennial streams. Consequently, when interpreting cultural remains at a site, it is important to include a consideration of the potential influence that geologic media and landscape position have had on the physical record.

Based on the generally high alkalinity typical of soil orders found in the ROI, the majority of soils at individual sites are anticipated to be neutral (pH 6.5 to 7.3) or mildly alkaline (pH 7.3 to 7.8). Soils with a pH of less than 6.3 have been found to be too acidic for bone preservation (Hole and Heizer 1965:230; Heizer and Graham 1967:125). On the other hand, a pH of 6.0 has been said to be the highest level tolerated by pollen (Moore and Webb 1978:15); however, this cutoff point may be as high as 7.0 in arid or semiarid climates (Hole and Heizer 1965:282). The generally dry, neutral, or alkaline soil conditions within the ROI lessen the potential for finding pollen within the soil profile. These same soil conditions will, however, provide a suitable environment for the preservation of bone.

Table 2.6.1-1

MAJOR SOIL ORDERS IN THE ROI

Soil Order	General Characteristics
Entisol	No pedogenic horizons
Aridisols	Pedogenic horizons, low in organic matter; dry more than 6 months of year in all horizons
Mollisols	Nearly black, organic-rich surface horizons and high base supply
Alfisols	Gray to brown surface horizons, medium to high base supply, and subsurface horizons of clay accumulation; usually moist

Source: Birkeland (1974)

2.6.1.3 Geology

The ROI is located in the Denver Basin, a large, asymmetrical, elongate feature underlying most of eastern Colorado and smaller portions of western Nebraska and southeast Wyoming (Figure 2.6.1-3). In the project area, the boundaries of the basin are formed by the Laramie Range on the west, the Hartville Uplift on the northwest, and the Chadron Arch approximately 150 miles (240 kilometers) northeast of Cheyenne. The west flank of the basin has undergone only minor deformation (Murray 1957). The axis of the basin trends approximately north-south through Cheyenne.

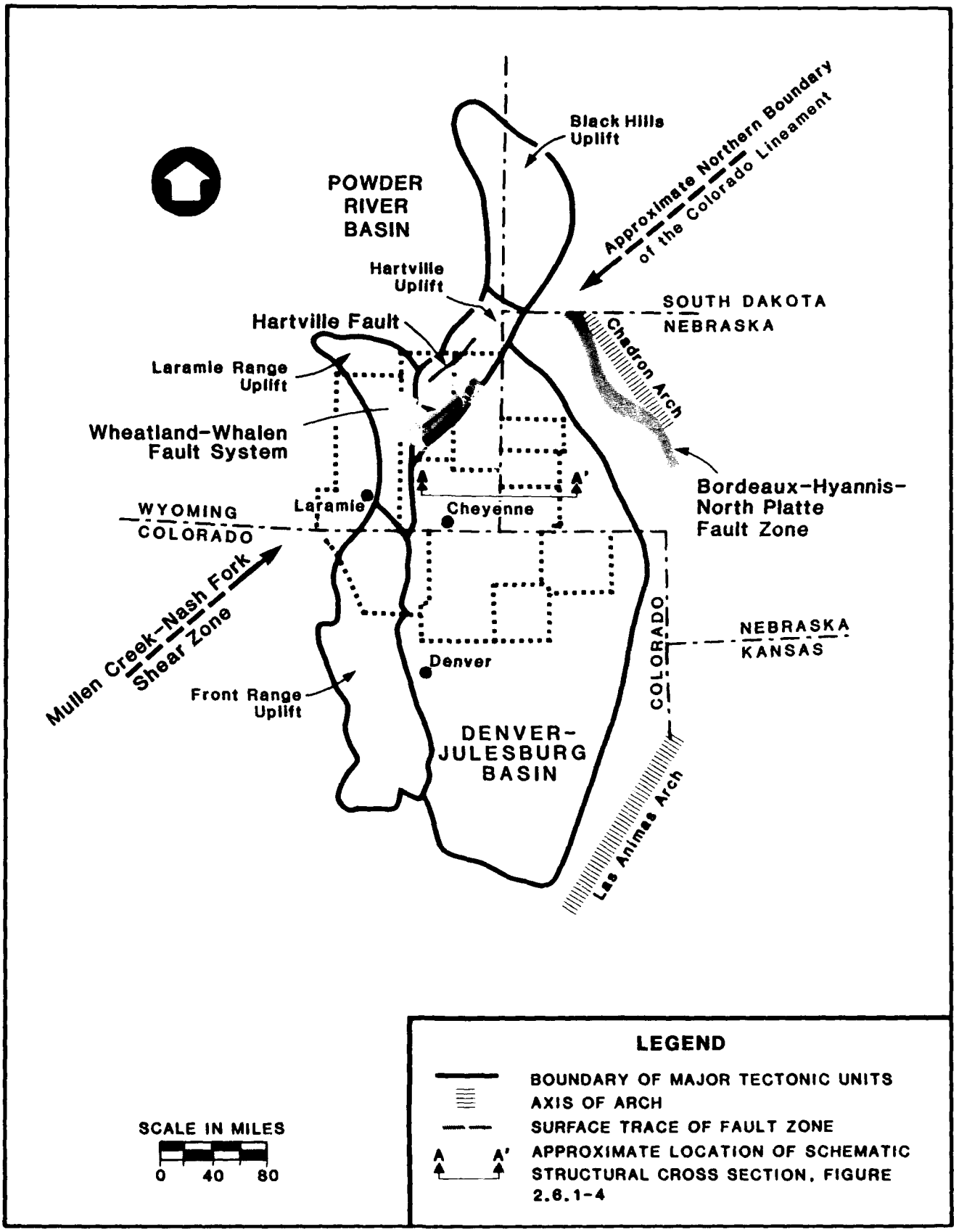
Pre-Tertiary sedimentary rocks, which may have a total thickness of as much as 12,000 feet (3,600 meters), underlie the basin and are exposed in a narrow belt along the flanks of the Laramie and Colorado Front ranges (Figure 2.6.1-4). These deposits are characterized by a sequence of marine and nonmarine sandstones, shales, and limestones with minor amounts of evaporite deposits. The oldest known sedimentary rocks are conglomeratic sandstones of the Flathead Formation.

Tertiary-age sediments underlie the High Plains surface and contain the most important and abundant fossil-bearing formations within the ROI. The Tertiary sequence consists of the White River Group (Oligocene), the Arikaree Formation (Miocene), and the Ogallala Formation (Mio-Pliocene). The White River Group is sometimes divided into the Chadron and Brule formations. The Chadron Formation consists of a lower fluviatile sequence ranging in grain size from clay to very coarse gravel and an upper unit comprised mainly of bentonitic clay and silt with local occurrences of coarse-grained channel deposits, lenticular limestone beds, and volcanic ash. The Chadron Formation attains a thickness of as much as 700 feet (215 meters) in places (Libra et al. 1981). The Brule Formation consists of bentonitic siltstone or silty claystone with local channel deposits of sand and sandstone, limey siltstone, and volcanic ash. In Goshen County, the Brule Formation is up to 450 feet (136 meters) thick and approximately 540 feet (165 meters) thick in Banner County, Nebraska (Smith and Souders 1975).

The Arikaree Formation is a fine-grained massive sandstone that contains beds of siltstone and thin beds of volcanic ash. A basal conglomerate is present in many localities. Erosion has removed the Arikaree in many areas (e.g., the Goshen Hole), but it does occur within most of the ROI. It is up to 1,200 feet (365 meters) thick in Goshen County (Libra et al. 1981) and thins to the south and east, where it is about 400 feet (120 meters) thick in Scotts Bluff County (Darton 1903) and 500 feet (152 meters) thick in Laramie County (Cooley and Crist 1981).

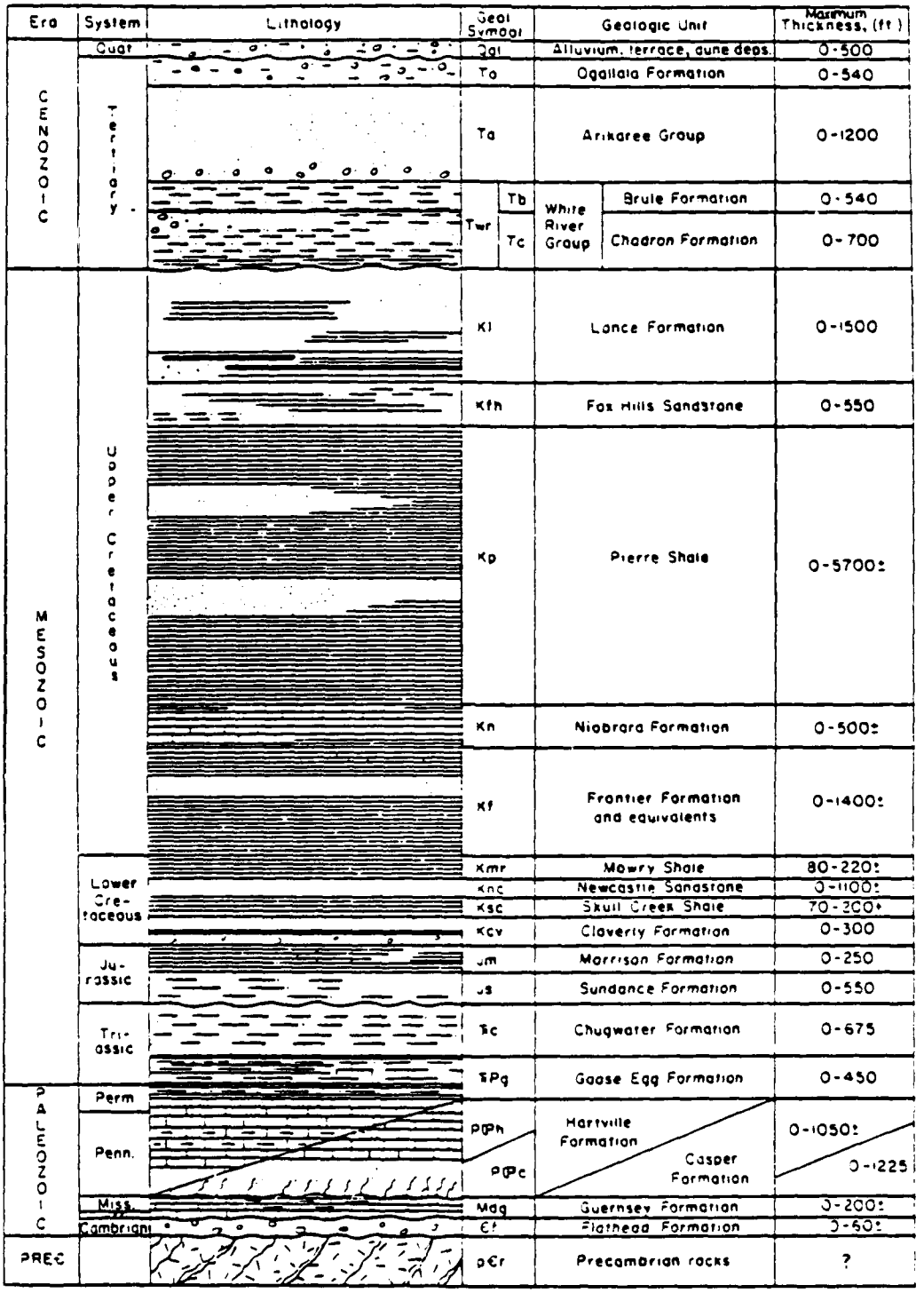
The Miocene/Pliocene Ogallala Formation unconformably overlies the older rocks and contains beds of sand and gravel, silt, clay, and limestone. The Ogallala is over 300 feet (90 meters) thick in western Laramie County (Lowry and Crist 1967; AFRCE-BMS 1983) and attains a maximum of about 540 feet (165 meters) in Banner County, Nebraska (Smith and Souders 1975).

Quaternary sediments consist of alluvium, terrace deposits, and floodplain deposits that typically consist of lenticular beds of poorly sorted clay, silt, sand, gravel, and boulders. Thick deposits of alluvium are known only in areas immediately underlain by the White River Formation. Alluvium along



MAJOR STRUCTURAL FEATURES OF THE DENVER-JULESBURG BASIN REGION

FIGURE NO. 2.6.1-3



(Modified from Libra et al. 1981)

DATA SOURCES: Morris and Babcock(1960), Lowry and Crist(1967), Smith and Souders(1975), Gottula(1980), Libra et al.(1981)

GENERALIZED STRAGRAPHIC COLUMN FOR THE NORTHERN DENVER-JULESBURG BASIN REGION

FIGURE NO. 2.6.1-4

Lodgepole Creek was generally thin but may be up to 85 feet (26 meters) thick locally. Alluvium underlying one of the younger stream terraces along Lodgepole Creek was 107 feet (32 meters) thick in one drill hole (Lowry and Crist 1967). Gottula (1980) reports 500 feet (152 meters) of alluvium near the confluence of Pumpkin Creek and Lawrence Fork valley in western Morrill County, Nebraska.

Terraces are widely distributed within the ROI and generally are topographically high. Terraces are reported along the North and South Platte rivers, the Laramie and Chugwater rivers, as well as along Horse and Lodgepole creeks and in the Pine Bluff Lowland. Terraces along Horse Creek and in the Pine Bluffs Lowland are underlain by thick deposits of alluvium. Undoubtedly, other streams in the ROI have similar features that are unreported in the scientific literature.

Most streams and dry washes are underlain by floodplain deposits. The thickest of these are in the Pine Bluffs Lowland, where deposits are as much as 85 feet (26 meters) thick; elsewhere, these deposits are less than 50 feet (15 meters) thick.

2.6.1.4 Hydrology

This section summarizes groundwater hydrologic properties that may have affected the location, density, and distribution of past cultural activities. In a semiarid climate, aquifers greatly affect local biomes primarily through surficial discharge in springs. The EPTR for water resources describes aquifers and surface water resources in the ROI. This discussion focuses on major streams and springs in the ROI.

Perennial streams and the flowing reaches of intermittent streams provide sources of water for human groups and for game animals. The major perennial and intermittent water drainage systems in the ROI are shown in Figure 2.6.1-2. The interaction of surface drainage systems and subterranean aquifers influences natural surface water distribution in the ROI. A particularly important consideration is the occurrence of seeps and springs. Lateral variation in the hydraulic properties of an aquifer is a major mechanism for creating seeps and springs within intermittent drainages. Lateral decreases in hydraulic conductivity, for example, can increase the potential for vertical flow, thereby moving the water table closer to the surface of the ground and increasing the potential for groundwater seepage to the surface.

The distribution of springs also is controlled by stratigraphy within the ROI. The largest number of springs originate from aquifers in Tertiary rocks although some springs have been reported issuing from Paleozoic strata. Eisen et al. (1980) indicate that springs from the Paleozoic aquifer system are present along the Hartville Hills.

The Tertiary aquifer system has springs that arise at the contacts between the Ogallala, Arikaree, and White River formations. Such spring systems have been documented along escarpments bounding the Goshen Hole and the Pine Bluffs Lowland (Rapp et al. 1953, 1957). Additional springs have been observed from the Ogallala Formation in western Laramie County. A large number of springs are present along minor tributaries in the Horse Creek drainage basin. These

springs occur near the Ogallala-Arikaree contact on the south side of Horse Creek.

2.6.1.5 Climate

Climatic conditions in a region are major controlling factors of the spatial distribution of essential resources (flora, fauna, water) required by human populations. Major compositional changes in wildlife communities are dependent on the magnitude and direction of climatic changes. During drier episodes, certain species (e.g., bison) would decrease in abundance and range proportional to the severity of the decline in short-grass foliage. With increases in woody shrub vegetation, species adapted to such a habitat (e.g., elk) would be expected to increase in range and abundance. Consequently, the resource base available to human groups obviously would shift, and adjustments in subsistence and settlement patterns would have to be made accordingly.

2.6.1.5.1 Existing Climate

The climate of the ROI is classified as semiarid and is typified by low annual precipitation rates, high evaporation rates, and wide temperature extremes. Average annual precipitation can be as high as 20 to 40 inches (51 to 102 centimeters) in mountain regions. The High Plains typically have annual rates in the 10 to 20-inch (25 to 50 centimeter) range. The temperature range is extreme; mean January values are about 25°F (-4°C) and July values about 65 to 75°F (18 to 24°C).

2.6.1.5.2 Paleoclimate

During the late Pleistocene and Holocene on the Central Great Plains, oscillations of temperature and precipitation were common. Table 2.6.1-2 lists the climatic episodes recognized from geological, archaeological, and palynological evidence. The number of recognized climatic episodes increases and their duration decreases from the late Pleistocene onward. This apparent trend towards a more complex climatic history is most likely the result of increasing data availability as one moves closer in time. Evidence for climatic change (e.g., pollen, fossils, landforms) during the Holocene is less likely to have been altered or destroyed. As a consequence, short-term Holocene climatic fluctuations with periods on the order of a few hundred years are recognizable, while climatic oscillations with periods of a few thousand years are generally recognizable for the late Pleistocene.

2.6.1.5.3 Biotic Response to Climatic Change

Species composition and abundance of vegetation communities is dependent on a variety of factors, including moisture availability, temperature, sunlight, and soil characteristics. Likewise, successional patterns, which respond variably to climatic change, are dependent on local and regional environmental conditions. It is hypothesized that a dynamic equilibrium between semiarid short-grass and semiarid desert herb biomes was established in the ROI during the Holocene. In addition, woodland communities located on topographic breaks, along drainages, and at higher elevations provided important sources of economic resources for indigenous peoples.

Table 2.6.1-2

LATE PLEISTOCENE/HOLOCENE CLIMATIC
FLUCTUATIONS IN THE REGION OF INFLUENCE

Time Span	Climatic Episode	Climatic Parameters	Vegetation	Source
Present to 115 BP	--	warmer, drier	short grass	(9)
115 to 410 BP	Neo-Boreal	cooler, moister	short grass; minor steppe	(1)
410 to 760 BP	Pacific	cooler, drier		(2)
760 to 1,000 BP	Neo-Atlantic	warmer, moister	short grass; minor desert shrub	--
1,000 to 1,690 BP	Scandic	warmer, drier	xeric shrubs; minor short grass and woodland	(1)
1,690 to 2,640 BP	Sub-Atlantic	cooler, moister	short grass; minor semiarid shrub	(1)
2,690 to 4,680 BP	Sub-Boreal	cooler, moister	short grass	(3)
4,680 to 8,540 BP	Atlantic	cooler, moister		
6,500 to 7,000 BP	Drought-prone subepisodes	warmer, drier	short grass or xerophytic species	(4)
7,450 to 8,000 BP				(5)
8,450 to 9,140 BP	Boreal	warmer, moister	steppe	(3)
9,140 to 10,500 BP	Pre-Boreal	warmer, moister	boreal	(6),(3)
10,500 to 13,000 BP	Terminal Pleistocene	warmer, less seasonality	steppe and/or mosaic pine-savannah; grassland	(3),(6)
13,000 to 20,000 BP	Late Pleistocene	cooler	thin prairie steppe, taiga, tundra	(6),(7), (8)

Sources:
(1) Bryson and Wendland 1967
(2) Baerreis and Bryson 1965
(3) Hoffman and Jones 1970
(4) Reeves 1973
(5) Wells 1970
(6) Bryson et al. 1970
(7) Guilday et al. 1967
(8) Anderson 1968
(9) Dice 1943

The use of data derived from short-term historic climatic fluctuations as analogic successional models has been seriously questioned (Reher 1977); however, such data still car provide useful information about the direction and magnitude of successional changes.

The effects of historic droughts on the short-grass communities are well documented (Coupland 1958; Tomanek and Hulett 1970). As Reher (1977:28) notes, "there are significant losses in grass biomass and basal cover as well as major successional changes" during unusually dry periods. The reduction in grass biomass is dominated by the restriction of buffalo and blue grama grasses to moist topographic areas. Forbs respond to drought by thinning of stands. Although their mortality is high, forbs (e.g., Artemisia frigida) will gradually increase in abundance and distribution; however, less xeric forbes tend to disappear and even more persistent species become greatly reduced in numbers. At the same time, weedy plants (e.g., Chenopodium and Amaranthus), grasses, and cacti (e.g., Opuntia yucca) increase (Albertson and Weaver 1946). Overall, biomass loss due to this successional sequence can be high and is not replaced by species adequate for forage (Reher 1977).

Episodes of prolonged higher than normal precipitation result in amelioration of short-grass communities. Coupland (1958) has documented a 200-percent increase in biomass for a northern mixed prairie as a consequence of an unusually moist period. Such a post-climax community would be expressed in increased height and basal cover of buffalo and blue grama grasses and a probable increase in the abundance of lesser species (e.g., bluestem, needle grass, and side-oats grama).

The impact of climatic change on the distribution of woodland stands on the High Plains remains unclear (Wells 1970; Wright 1970; Beetle 1974). The critical aspect of this community appears to be soil moisture; once established, however, dominant species are reasonably drought-resistant. Wood (1967) suggests that variation in woodland distribution is a function of water availability and competitive pressure exerted by grasses, which generally are more successful in arid parts of their range. Extrapolating to the entire Holocene, it is suggested that woodland species would have expanded their range along escarpments and perennial streams during moisture episodes and become more restricted during drier intervals.

2.6.1.5.4 Geomorphic Evidence of Climatic Change

Recent geologic and archaeological research has developed an awareness of the relationship between climatic change and landscape evolution. Such changes affect erosional and depositional environments and thus the geomorphic structure of an area. By correlating the formation of landscape features with materials from dated archaeological sites, it is possible to relate the chronology of regional geologic events to its associated climatic sequence. Concurrent with this awareness, however, came the realization that the landscape often has a complex response to climatic change. Fluvial terraces often are cited as evidence for changes in climate, but within the ROI the number of terraces is not consistent for all drainage basins. Multiple terraces have been reported along the North Platte River, two along upper Lodgepole Creek, and one along its lower reaches. Other terrace systems undoubtedly exist along drainages in the ROI but have not been reported in the scientific literature. As a consequence, it is important to recognize that

terraces probably are not regionally time-correlative. Within each drainage basin, streams respond to climatic change within the constraints of local geologic and hydrologic conditions.

2.6.1.6 Flora

The Central High Plains subarea is dominated by the semiarid short-grass vegetation of the Kansan Biotic Province (Dice 1943). In addition to including numerous species that were of direct economic importance to the diet of indigenous people, the region's vegetation formerly supported tremendous numbers of large herbivores (e.g., bison) that were critically important to the subsistence-settlement systems of Plains cultural groups. The composition and distribution of vegetal communities within the area are a reflection of climate, topography, and hydrology. The interrelationship of these variables is described by Wedel (1961:38):

> In the short grass plains, the subsoil is permanently dry and moisture is at a premium. The characteristic grasses are grama and buffalo grass. These are low-growing, shallow-rooted, sodforming types, capable of quick growth on the spring moisture after which they may pass into a dormant stage when the rains cease. On mountainous, hilly, or rugged lands, such as the Black Hills of South Dakota, the Rawhide Buttes in Wyoming, the Piney Buttes and larger, isolated masses of elevated land in Montana, and the Cypress Hills, coniferous and/or deciduous trees flourish.

Within the ROI, the vegetation is totally dominated by short grasses and grasslike species (e.g., buffalo grass, blue grama, and sedges). Other species present include sand-drop seed grass, needle-and-thread grass, sand sagebrush, and fringed sagewort, among others.

2.6.1.7 Fauna

The faunal communities represented in the Northern Great Plains have been described as belonging to five biotic regions (Hoffman and Jones 1970). These elements include: 1) grassland (steppe) species of the Great Plains; 2) steppe or desert species that originated in the Southwest; 3) coniferous forest species of the boreal forest or Rocky Mountains; 4) decidous forest species that reach their western limit on the Plains; and 5) a limited number of nontropical species from the south and a group of species with widespread North American distributions.

Several mammalian species (Greiser 1980) and a variety of birds, fish, amphibians, and reptiles are found on the Central High Plains. Typical bird species include sage grouse, eagles, hawks, and a variety of waterfowl. Reptiles and amphibians include a variety of snakes (e.g., bullsnakes, vest or garter snakes, prairie rattlesnakes), lizards, and frogs. Fish species typical of the waters of the Central High Plains include perch, walleye, and trout. Although many of these species found their way into the diet of the region's human populations, large game mammals (e.g., bison, deer, antelope, and elk) were the most important component of the prehistoric and early historic subsistence system. Indeed, the pursuit of and dependence upon bison are the

hallmarks of Plains Indian culture, and, as will be seen in subsequent discussions, such was the case for several millenia.

2.6.2 Prehistoric Cultural Resources

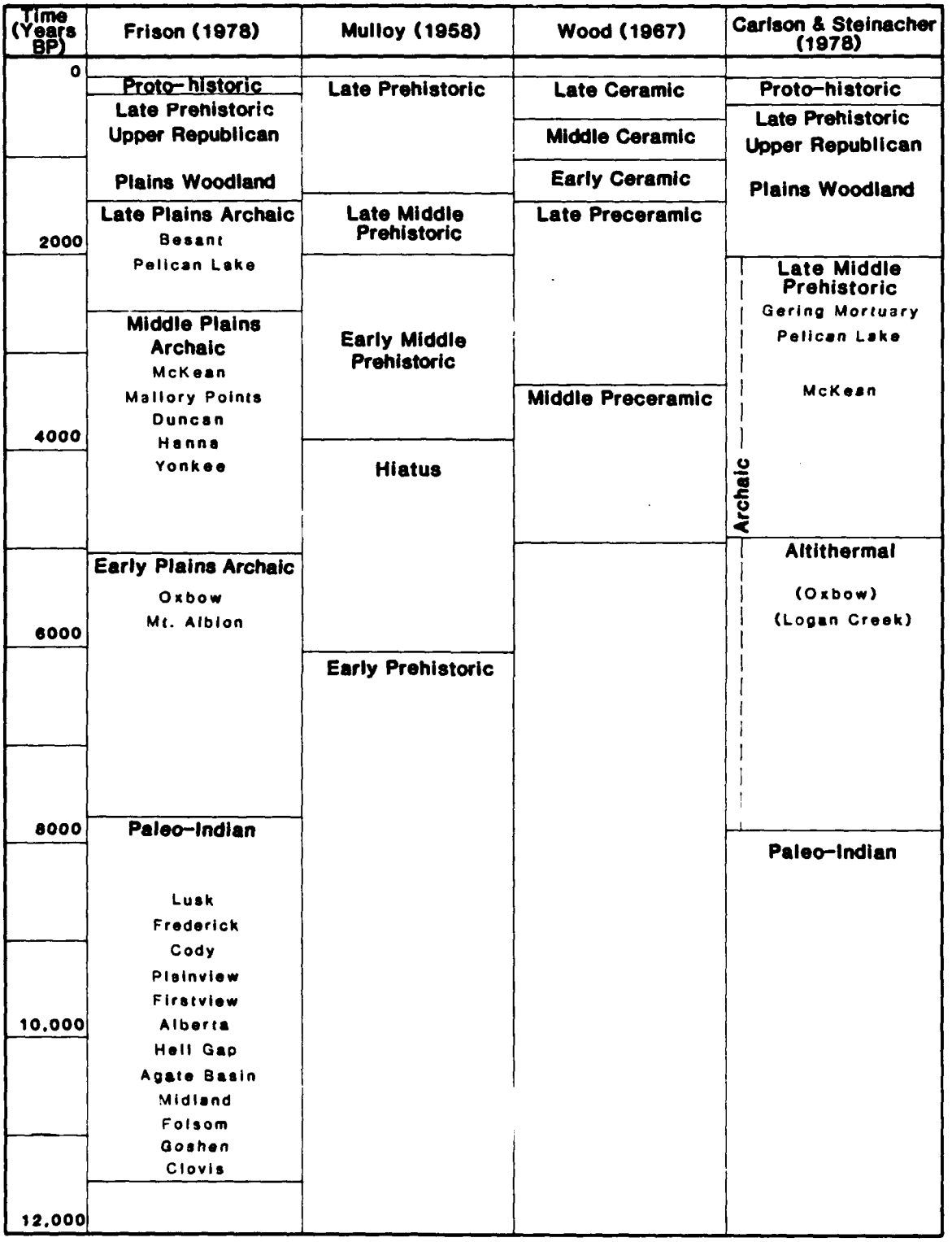
The following section summarizes available information concerning the lifeways, technology, and settlement-subsistence patterns of various prehistoric groups that occupied or used the project ROI. The discussion is divided into three parts. A chronological overview of regional prehistory is presented, organized according to major cultural periods. This narrative provides a general interpretive framework for establishing existing baseline conditions and predicting future trends, which are the subjects of succeeding sections.

As noted in Section 2.6.1.1, the area contained within the ROI lies within two major physiographic provinces: the High Plains and the Southern Rocky Mountains. Not surprisingly, this same area also encompasses at least two major cultural units - the Central Plains and Northwestern Plains - that have been defined by previous researchers (Wedel 1961; Frison 1978). Given that the boundaries of the ROI bear no necessary correspondence to such proposed natural or cultural areas, adequate treatment of ROI prehistory is not possible if discussions are wholly restricted to this arbitrarily defined region. Data from surrounding areas are needed to provide the proper context within which to understand the local prehistoric cultural record. Consequently, discussions in ensuing sections contain references to findings at sites external to the ROI where inclusion of such data is crucial to characterizing local culture history.

2.6.2.1 Overview

The following narrative presents a summary of regional prehistory. The discussion divides the temporal continuum into several units corresponding to major cultural periods that have been used by most researchers to characterize the archaeological record. For these temporal-cultural units, defining attributes are introduced along with summaries of findings at selected sites both outside and inside the ROI.

A review of the literature pertaining to the prehistory of the region as a whole reveals that four somewhat different cultural chronologies are used by most researchers as the basis for classifying material cultural remains (Figure 2.6.2-1). The earliest of these, Mulloy's (1958) chronology for prehistoric cultures of the Northwestern Plains, is still widely referred to by researchers but has been largely supplanted by Frison's (1978) more recent offering. In many respects, the two temporal frameworks are much alike; nevertheless, they also differ in important ways. Wood's (1967) system is intended to characterize the prehistory of northeast Colorado, and Carlson and Steinacher's (1978) scheme applies to Nebraska. The discussion that follows is largely structured according to Frison's (1978) ordering, but descriptions of several other temporal units are interspersed in the narrative where appropriate.



PREHISTORIC CULTURAL CHRONOLOGIES FOR THE REGION OF INFLUENCE

FIGURE NO. 2.6.2-1

2.6.2.1.1 Paleo-Indian Period (ca. 11,500-7500 BP)

The earliest evidence of man's occupation in North America is ascribed to the Paleo-Indian period. This period is divided into two parts: 1) an early Paleo-Indian period, which consists of the pre-Clovis, Clovis, and Folsom complexes; and 2) a late Paleo-Indian period, which includes, but is not limited to, the Midland, Agate Basin, Hell Gap, Alberta, Cody, and Frederick complexes.

2.6.2.1.1.1 Early Paleo-Indian Complexes

Pre-Clovis. Well-documented pre-Clovis sites are rare in North America. The majority of information pertaining to pre-Clovis cultures has been obtained from two sites: Meadowcroft Rockshelter in western Pennsylvania (Adovasio et al. 1978a,b) and the Dutton-Selby site in northeast Colorado (Stanford 1979). Because pre-Clovis sites have yet to be discovered in the ROI, this overview will commence with a discussion of the more recent Clovis complex.

Clovis Complex. The earliest well-defined cultural unit in North America is the Clovis complex, which appeared during the Late Glacial climatic episode that occurred from 13,000 to 10,500 years BP. The hallmark of this complex is the Clovis projectile point, easily recognized by its fluted blade, lanceolate shape, and collateral flaking.

Clovis sites and artifacts are widespread on the Plains. Within the ROI, Clovis finds include the Dent Site (5-WL-269), a mammoth kill site in north-central Colorado that dates to approximately 11,200 BP (Wormington 1957). Additionally, mammoth remains and Clovis points are reported from loess deposits near the Hell Gap site in Wyoming (Frison 1978). Husted's survey of Rocky Mountain National Park showed that human occupation of the high alpine zone began ca. 10,950 BP as evidenced by Clovis points found on the ground surface (Haug 1968). Dated Clovis sites near the ROI include: 1) the Colby site (11,250 and 10,550 BP), a mammoth kill and butchering site in the Big Horn Basin (Frison 1978); 2) the Sheaman locality at the Agate Basin site (11,830 BP), a camp/processing site near the Wyoming Black Hills (Frison and Stanford 1982); 3) the Clovis levels at the Dutton site (11,170 BP), a campsite in northeast Colorado (Stanford 1979); and 4) the Union Pacific Mammoth site (11,380 BP), a possible mammoth/Clovis association in south-central Wyoming (Haynes 1970). In addition, surface finds have been recorded throughout the Plains.

Despite the substantial number of Clovis sites and components that have been investigated over the years, little is known about the subsistence-settlement activities of early man on the Plains. The Clovis sites that have been found to date are almost exclusively kill localities that reflect only a limited set of activities associated with the killing and butchering of large game animals. The Clovis tool kit includes end scrapers, large unifacial sidescrapers, keeled scrapers, unifacial and bifacial knives, flake knives, spokeshaves, gravers, burins, point blanks, cores, choppers, hammerstones, grinding stones, and various other artifacts (Haynes 1970).

Because Clovis projectile points have been found in association with extinct Pleistocene megafauna, especially mammoth, many archaeologists (e.g., Wormington 1957; Quimby 1958; Mason 1962; Haynes 1970) have assumed that

Clovis hunters subsisted primarily on such large game animals. Recent evidence and new interpretations (Gorman 1969; Hayden 1979, 1981; Greiser 1980) indicate, however, that Clovis hunters pursued various-sized game (e.g., camel, bison, deer, horse, rabbit, and small rodents) in addition to mammoth. Furthermore, the presence of grinding stones at some Clovis sites (e.g., the Colby site) strongly suggests that gathering and preparation of plant resources also contributed to the subsistence base. Such artifacts are rare, however, and Greiser (1980) hypothesizes that the lack of seasonal demands for stored resources precluded the need for drying and grinding of seeds for winter use. Therefore, the scarcity of ground stone tools from Clovis campsites does not necessarily indicate a lack of vegetal resources in the aboriginal diet.

The current data base suggests that the Clovis settlement system included four principal site types: kill sites, butchering sites, campsites, and limited activity sites (e.g., quarry sites, tool reduction stations, plant gathering localities). The majority of mammoth kill sites are associated with fossil playas or lake beds. Butchering sites usually are associated with kill sites. Campsites tend to be located in areas that allowed access to a variety of resources, including water, fuel, and shelter. In addition, campsites tend to be located in settings that command a view of the surrounding terrain and that are somewhat removed from kill localities (e.g., river terraces, upland ridges near playas or springs, and rockshelters). The locations of limited activity sites are difficult to predict because of the paucity of material remains discarded at such sites and the obscuring effects of post-depositional natural processes. Unfortunately, many of the more visible sites (e.g., quarry sites or lithic reduction stations) tend not to contain temporally diagnostic artifacts.

Despite current limitations in subsistence-settlement data for this period, certain tentative hypotheses have been advanced to account for the known archaeological record. Greiser (1980) speculates that Clovis people lived in small extended family units between the late spring and early fall. During the late fall and early winter, small bands congregated for the purpose of hunting large herds of herbivores. With the onset of winter and the attendant increased scarcity of food resources, these larger groups segregated into extended families and dispersed into sheltered locations until spring.

Based on present information about inter and intrasite patterning and ethnographic analogies to big-game hunters in Alaska and Canada (Helm 1969; Binford 1978), it is generally assumed that during much of the year Clovis people lived in small, highly mobile bands composed of several nuclear or extended families. Such patterns of seasonal movement are common among hunting and gathering groups that depend on gregarious migratory animals for their subsistence. Furthermore, both archaeological (Wheat 1972; Frison 1978; Greiser 1980) and ethnographic (Helm 1969; Binford 1978) data indicate that group size and membership were highly variable, depending on the season and the kinds of resources being exploited.

Goshen Complex. Following the Clovis complex, an apparent time gap of several hundred years occurs before the Folsom complex appears; Frison (1978) suggests that the Goshen complex may fill this apparent hiatus. To date, the only locality to produce artifacts attributable to this complex is the Hell Gap

site (48-GO-305), situated within the ROI in southeast Wyoming (Figure 2.6.2-2). Although no radiocarbon age determinations are available for the Goshen complex, its stratigraphic position indicates a post-Clovis, pre-Folsom occupation, and Irwin-Williams et al. (1973) suggest a tentative date of 11,000 to 10,750 BP.

Goshen-type projectile points are lanceolate in form with concave bases and collateral flaking. They exhibit fine craftsmanship and often display basal thinning and grinding. Other tools associated with this complex include various end and sidescrapers, perforators, utilized flakes, and point/knife preforms. Whether the Goshen complex represents a local event or a more widespread occurrence on the Plains has not yet been determined.

Folsom Complex. At approximately 10,950 BP, the Folsom complex was spreading throughout much of the Great Plains. Although Folsom occurrence is widespread, large undisturbed sites are few. An exception is the Lindenmeier site (5-LR-13), a well-known Folsom campsite, located north of Fort Collins, Colorado. This campsite is perhaps the most important of all known Paleo-Indian sites (Wilmsen 1974). Other sites within the ROI include Hell Gap (48-GO-305), another well-known locality that yielded a Folsom complex component in addition to evidence of almost every known Paleo-Indian complex on the Northwestern Plains (Irwin-Williams et al. 1973). The Johnson site (5-LR-26), situated in extreme northern Colorado, produced Folsom projectile points, tools, and debitage (Galloway and Agogino 1961), as did the Powars site (Haug 1968). At Bell Cave (48-AB-304) in Albany County, Wyoming, a Folsom point midsection was found in a disturbed context with extinct Pleistocene fauna, including marten, camel, and horse (Zeimens and Walker 1974).

The diagnostic artifact of Folsom tool technology is the Folsom projectile point. These points appear to be derived from earlier Clovis points in that they are lanceolate in shape, exhibit excellent workmanship, have concave bases with basal grinding, and display collateral flaking. The distinctive feature of the Folsom point is that the flute extends over half the blade length; unfluted Folsom points also have been discovered in association with fluted examples. Channel flakes (i.e., flakes removed in the production of fluted point bases) are a second diagnostic artifact of the Folsom assemblage.

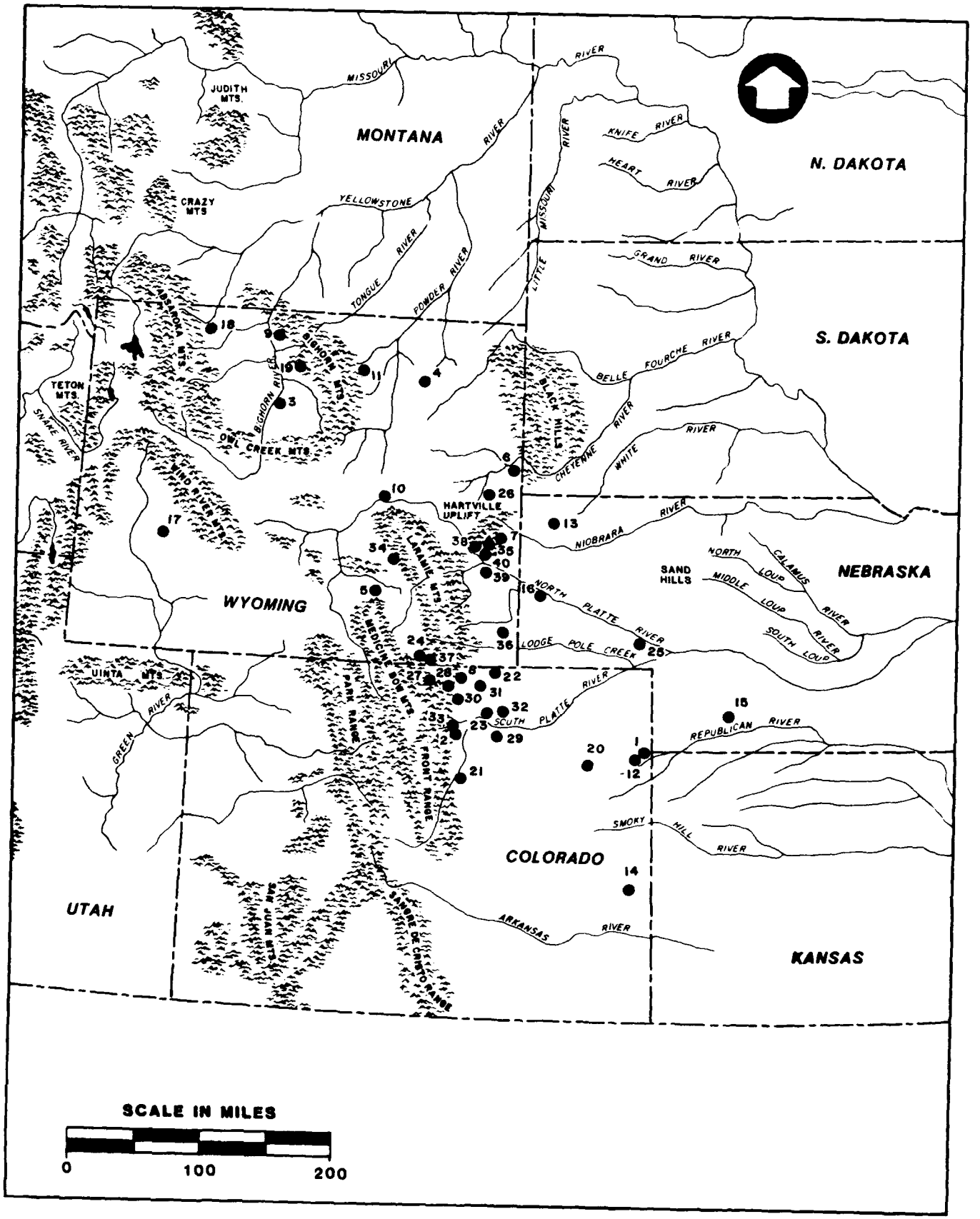
Although most artifacts show little change in form or function from the earlier Clovis complex, additional bifacially flaked artifacts include projectile point preforms, small to large bifaces or knives, and elongate tools suggestive of drills that lack evidence of use-wear. Unifacial specimens include endscrapers, sidescrapers (both single and double-edged), spokeshaves, gravers, and utilized flakes. Other artifact categories include cores, choppers, abrading stones, burins, grinding stones, and a wide variety of bone tools.

The majority of excavated Folsom sites are kill sites associated with the remains of the extinct Bison antiquus. Wormington (1957) and others maintain that this indicates a shift in preferred game from mammoths to bison. Faunal remains from the Lindenmeier site (Wilmsen 1968; Wilmsen and Roberts 1978) and Folsom levels at the Hell Gap site (Irwin-Williams et al. 1973) also indicate that a variety of large and small game animals (e.g., deer, pronghorn antelope, elk, camel, and rabbit) were exploited by Folsom groups. In addition, the use of floral resources is implied by the presence of groundstone tools.

Key to Figure 2.6.2-2

Selected Paleo-Indian Sites

1. Dutton-Selby Site (Pre-Clovis and Clovis)
2. Dent (Clovis)
3. Colby (Clovis)
4. Carter-Kerr McGee (Clovis, Folsom, Cody)
5. Union-Pacific Mammoth (Possible Clovis)
6. Agate Basin (Sheaman [Clovis], Brewster [Folsom], Agate Basin [Folsom] Localities)
7. Hell Gap (Goshen, Folsom, Midland, Agate Basin, Cody, Frederick)
8. Lindenmeier (Folsom)
9. Hanson (Folsom)
10. Casper (Hell Gap)
11. Sister's Hill (Hell Gap)
12. Jones-Miller (Hell Gap)
13. Hudson-Meng (Alberta)
14. Olsen-Chubbuck (Firstview)
15. Lime Creek and Red Smoke (Plainview?, Frederick)
16. Scottsbluff (Cody)
17. Finley (Cody)
18. Horner (Cody)
19. Medicine Lodge Creek (Cody)
20. Claypool (Cody)
21. Lamb Springs (Cody)
22. Wilbur-Thomas (Cody)
23. Jurgens
24. James Allen (Frederick)
25. Clary Ranch (Frederick)
26. Betty Greene (Lusk)
27. Gordon Creek Burial
28. Johnson (Folsom)
29. Frazier
30. Spring Gulch
31. 5-LR-525
32. Powars (Folsom)
33. 5-LR-23
34. Bell Cave
35. Rawhide Creek
36. Petsch Creek
37. 48-LA-459
38. 48-PL-11
39. Greyrocks
40. Patten Creek



SELECTED PALEO-INDIAN PERIOD SITES

FIGURE NO. 2.6.2-2

Considering that subsistence strategies remained relatively unchanged from earlier periods, it is not surprising that settlement patterns reflect a similar continuity. Presumably, site types include kill sites, butchering sites, campsites, and limited or special activity sites. The increased emphasis placed on bison hunting, however, resulted in a shift in kill site locations, with the majority of Folsom and later period bison kills situated in relict arroyos in upland settings. Because of the logistic problems encountered in transporting bison carcasses, butchering sites commonly are associated with kill sites. Campsite locations remain virtually unchanged from the Clovis period, reflecting similar subsistence strategies. Greiser (1980) argues that one important change in settlement pattern occurred during this time: increased seasonality reduced the number of base camp locations. Consequently, site reuse occurred with greater frequency than previously. At the Hanson site, Frison (1978:118) reports that "hard packed sandy floors define what are believed to be vaguely circular living structures although no discernable postholes outline the floors." Evidence of structures and hearths also was found in the Folsom levels at the Agate Basin site (Frison and Stanford 1982).

Based on similarities in inter and intrasite patterning and subsistence strategies, it is argued that social organization probably changed little from the earlier Clovis time period (Greiser 1980). Because of an increased emphasis on bison, which are more gregarious than mammoths, Greiser (1980) postulates that multifamily or multiband kills may have occurred more frequently.

2.6.2.1.1.2 Late Paleo-Indian Complexes (ca. 10,000-7500 BP)

Several late Paleo-Indian complexes apparently flourished on the Northwestern and Central Plains between approximately 9950 and 7950 BP. Numerous representative sites (including kill sites, butchering sites, and campsites) have been excavated and surface finds are common, especially along the North Platte River drainage in Wyoming and Nebraska as well as the Glendo Reservoir area (Frison 1974) in Wyoming and the South Platte drainage basin in Colorado (Morris et al. 1979).

Midland Complex. The Midland point is generally considered similar to, but distinct from, the Folsom point (Agogino 1969; Irwin and Wormington 1970). Midland points are well-made, lanceolate in shape, and have concave bases that exhibit basal thinning and grinding. They typically are extremely thin, perhaps to facilitate hafting.

Although the Midland complex is considered to be contemporaneous with the Folsom complex, Midland deposits overlie Folsom deposits at the Hell Gap site, while at the type-site near Midland, Texas, the former lies below the latter. Midland deposits at the Hell Gap site have been dated between 10,690 and 10,390 BP. A Midland campsite (48-PL-11) also has been reported along the North Platte River near the Hell Gap site. Finally, a possible Midland point was recovered from the lowest levels of Signal Butte Rockshelter (25-SF-1) in western Nebraska (Strong 1935). All three of these sites are found within the ROI.

Agate Basin Complex. Following the Midland complex in time is the Agate Basin complex (Frison 1978). The diagnostic projectile point of this complex is characteristically a long, narrow, lanceolate blade with convex edges and a slightly concave base. These points are lenticular in cross section, exhibit basal grinding and thinning, and usually are well made. The Agate Basin type-site, a bison kill and butchering site in extreme eastern Wyoming, produced a date of 10,430 BP (Frison 1978). The Brewster site (also in the Agate Basin locality) produced dates of 9990 and 9350 BP (Frison 1978). The Agate Basin level at the Hell Gap site, the best represented Paleo-Indian assemblage at this locality, has not been radiocarbon dated, but Irwin-Williams et al. (1973) suggest a date of 10,450 BP. An Agate Basin component also was excavated at the Carter Kerr-McGee site in northeast Wyoming, but no dates were obtained (Frison 1977).

Hell Gap Complex. Based on morphological attributes and chronological placement, the Hell Gap complex appears to be derived from an overlap with the Agate Basin complex. Hell Gap projectile points are reminiscent of Agate Basin specimens in that both are lanceolate in shape, their bases are straight to slightly convex, and they exhibit collateral flaking and basal grinding and thinning. Unlike Agate Basin points, however, Hell Gap points attain their maximum width about two-thirds of the way up the blade. At the Hell Gap site and adjacent localities, Hell Gap materials consistently overlie Agate Basin materials. A charcoal sample below the Hell Gap occupation levels produced a date of 10,250 BP, prompting Irwin-Williams et al. (1973) to suggest a date of 9950 to 9450 BP for Hell Gap occupations.

Several other sites outside the ROI have produced important Hell Gap components. The Casper site, a bison kill site along the North Platte River in central Wyoming, yielded dates of 10,060 and 9830 BP (Frison 1974), while the Sister's Hill site, an occupation site south of Buffalo, Wyoming, produced dates of 9650 and 9600 BP (Agogino and Galloway 1965). At the Carter-Kerr McGee site, Zeimens (1976) and Frison (1977) report Hell Gap points are found in association with Agate Basin points, but, unfortunately, radiocarbon dates for this occupation level were not obtained. Finally, radiocarbon dates from Hell Gap levels at the Agate Basin site (ca. 10,450 BP) suggest an overlap in time with Folsom and Agate Basin points (Frison and Stanford 1982). The Jones-Miller site is an Agate Basin bison kill and butchering site in extreme northeast Colorado (Stanford 1974, 1975). Although no radiocarbon dates have been published for this site, Stanford (1975) suggests an age of approximately 9950 BP. An unusual feature recorded at the site was a large postmold surrounded by nonfunctional artifacts near the center of a bone concentration. Stanford (1975) suggests that this feature may have had ceremonial significance and possibly functioned in a manner comparable to the "medicine post" reported in historic sources.

Alberta Complex. The Alberta projectile point resembles the Scottsbluff point but is more robust in form and has a more northerly distribution. The Alberta complex at the Hell Gap site lies stratigraphically above Hell Gap levels and below Cody levels. A charcoal sample from a level above the Alberta component produced a radiocarbon age of 8550 BP, and Irwin-Williams et al. (1973) suggest a time range between 9450 and 8950 BP for the Alberta levels.

The Hudson-Meng site, a bison kill site in northwest Nebraska, produced dates ranging from 9800 to 8990 BP, but Agenbroad (1978) considers the earlier date

the most reliable (Frison 1978). Alberta points also have been recovered as surface finds in the Big Horn Mountains and the Green River Basin of western Wyoming (Frison 1978).

Firstview Complex. Contemporary with the Alberta complex is the Firstview complex. Wheat (1972) defines the Firstview complex on the basis of material recovered from the Olsen-Chubbuck site (10,150 BP) in east-central Colorado. Although the projectile points originally were classified as Eden, Scottsbluff, and Milnesand, further analysis led Wheat to conclude that they should be reclassified and assigned to a new type: the Firstview point. Wheat (1972) defines these points as lanceolate in shape with stems, straight bases, and convex edges. Blade width is variable, but length tends to be uniform. Wheat (1972) also includes several other types of points in the Firstview complex (e.g., San Jon, Plainview, Agate Basin, Milnesand) and suggests that the complex may extend to as late as 8500 BP. Not all archaeologists, however, have accepted Wheat's conclusion, which subsumes the Plainview and Milnesand complexes under the Firstview complex.

Plainview Complex. The Lime Creek (ca. 9450 BP) and Red Smoke (no date) sites, both campsites located near Jasper Quarry in western Nebraska, have been identified by Davis (1953, 1962) and Wormington (1957) as belonging to the Plainview complex. Wheat (1972) argues, however, that the points are improperly identified and should be classified as San Jon, thus placing them in the Firstview complex.

Cody Complex. The Cody complex, which is parallel to, but distinctive from, the preceding Firstview complex, is widespread over the Northwestern and Central Plains. Diagnostic artifacts of the Cody complex include Eden points, Scottsbluff I, II, and III points (Wormington 1957), and the Cody knife. Because these point types grade into one another, Wormington (1957) suggests calling all of them Cody points.

The type-site for Scottsbluff points is the Scottsbluff Bison Quarry (25-SF-2), located within the ROI in the extreme western portion of the Nebraska Panhandle, where these points were found in association with a bison kill. The type-site for the closely related Eden point is the Finley site, which is located near the town of Eden in southwest Wyoming (Moss et al. 1951). Finally, the Horner site, located near Cody in northwest Wyoming, is the type-site for the distinctive Cody Knife (Jepsen 1953).

The Cody complex is dated to 8600 BP at the Hell Gap site (48-GO-305) (Irwin-Williams et al. 1973). At the Medicine Lodge Creek site in the Big Horn Mountains, the level that produced materials identified as Cody complex was dated at 8830 BP (Frison 1976a). The Cody level at the Carter-Kerr McGee site produced several point types (Eden, Scottsbluff, Alberta, and Folsom) that Zeimens (1976) and Frison (1977) interpret as evidence of cultural mixing or multiple occupations.

Within the Central Plains, the Cody complex is best represented at the Claypool site, a campsite in extreme northeast Colorado. According to Stanford and Albanese (1975), this site is one of only two campsites (the other being the Horner site) that have produced Cody knives in association with Eden or Scottsbluff points. The Lamb Springs site, near Denver, Colorado, also produced evidence of Eden-Scottsbluff occupation (Wedel 1963;

Stanford et al. 1981). Radiocarbon samples from the site yielded dates of 8870 and 7870 BP. The Wilbur Thomas shelter (5-WL-45) in northeast Colorado produced Scottsbluff materials but no dates have been reported (Breternitz 1971).

Frederick Complex. Terminal Paleo-Indian occupation on the Northwestern and Central Plains is represented by various local and regional projectile point styles that are morphologically dissimilar from those of previous complexes. These points are characterized by parallel-oblique flaking, loss of shoulder and stem on the base, and straight to slightly concave bases (Frison 1978). Of importance to the study area is the Frederick complex, which was defined by Irwin-Williams et al. (1973) at the Hell Gap site, where investigations suggest a time range of 8400 to 8000 BP for the complex.

Besides changes in projectile point style, the Frederick complex at the Hell Gap site indicates a shift in subsistence activities that reflects a more broad-based economy than was represented earlier. In addition to bison bones, a large quantity of deer bones was noted, as well as small mammal bones and a few freshwater mollusks. The bone tool industry is more developed than earlier and includes well-made bone awls and several incised bone beads. Additionally, the presence of a circle of stones, possibly remnant of a small, temporary shelter, may indicate shifting settlement patterns.

Lusk Complex. Less well made than those of the Frederick complex but still somewhat similar, the Lusk point is reported from the Betty Greene site (Green 1967) situated near the town of Lusk, just north of the ROI. A radiocarbon date of about 7900 BP is given for this site (Frison 1978).

James Allen Complex. The James Allen assemblage was recovered from a bison kill site (48-AB-4) in the Laramie Basin in southern Wyoming and was radiocarbon dated to about 7900 BP. No evidence of the kill method was noted, but lithic flakes and tools were found scattered among the disarticulated bones of about 15 Bison occidentalis or B. antiquus (Berman 1959; Mulloy 1959). James Allen points are characterized by either slight lateral restrictions or parallel sides and deeply concave bases somewhat similar to points of the Frederick complex (Frison 1978).

Additional possible variants of terminal Paleo-Indian manifestations found outside the ROI include the Pryor Stemmed, Lovell Constricted, and Angostura assemblages, among others (Frison 1978).

Discussion. Except for changes in projectile point morphology, tool assemblages recovered from various late Paleo-Indian complexes demonstrate a remarkable degree of homogeneity both among themselves and with the earlier Clovis and Folsom assemblages. Wheat (1972) maintains that such continuity and homogeneity in tool assemblages can be attributed to similarities in subsistence strategies and standardized hunting, butchering, and processing methods.

As with earlier Paleo-Indian assemblages, the majority of late Paleo-Indian tools have been obtained from bison kill and butchering sites. Consequently, most tools are associated with these activities. Common tools associated with late Paleo-Indian complexes include projectile point and knife preforms, various knives and bifacially flaked blades, a variety of endscrapers, single

and double-edged sidescrapers, raclette scrapers, notched flakes, spokeshaves, drills, perforators, gravers, utilized and retouched flakes, denticulates, burins, choppers, hammerstones, abraders, groundstone tools, and a wide variety of bone tools. Unfortunately, more perishable items (e.g., digging sticks, atlatls, baskets, clothing) have not been recovered from Paleo-Indian sites. Thus, the nature of these items and their stylistic changes through time remain unknown.

Little is known about subsistence strategies employed by the various late Paleo-Indian cultures, but available evidence indicates that bison were the preferred game. Faunal remains from the Hell Gap site and other late Paleo-Indian sites suggest, however, that other animals (e.g., deer, antelope, and rabbit) continued to supplement the diet. Excavations at various bison kill sites indicate that a variety of hunting strategies were employed, probably beginning as early as the Folsom period and continuing throughout the Paleo-Indian period. Bison kill remains are generally found in association with geomorphic features such as deeply cut arroyos or parabolic sand dunes, where the animals apparently were driven, trapped, and quickly dispatched; often they were butchered on the spot. A bison procurement site situated within the ROI, the James Allen site, is one of the latest known Paleo-Indian sites of this type. Unfortunately, it was found in an area of almost no topographic relief, and information regarding the method of bison procurement is absent (Frison 1978).

Archaeological evidence of plant resource utilization, either in the form of plant remains or plant processing implements (e.g., groundstone tools) is scant for the Paleo-Indian period. The paucity of such remains, however, may be a reflection of the types of currently known archaeological sites (i.e., kill and butchering sites) rather than an indication that these groups excluded plant resources from their diet. At this point, it is assumed that plant resources were used as they became available seasonally. For example, greens and tubers probably were collected in the late spring to early summer and fruits, seeds, and nuts were gathered during the late summer to early fall.

Little is known about settlement patterns during the late Paleo-Indian period, but subsistence strategies no doubt dictated both settlement locations and fluctuations in group size to a large degree. Because the subsistence base remained relatively unchanged from the early Paleo-Indian period, site types are probably similar. Wheat (1978) suggests several lines of evidence that may be used to delineate kill sites, butchering and processing sites, and short and long-term campsites. As noted for the early Paleo-Indian period, limited or special activity sites are difficult to identify and interpret. Although the location of kill sites probably varied depending on local topographic conditions, the spatial relationship of butchering and processing sites to kill sites remained unchanged (i.e., butchering sites were, by necessity, adjacent to kill sites). Likewise, many campsites were in close proximity to kill and butchering sites, especially if these locations allowed access to water, fuel, and shelter.

Although a further delineation of plains-oriented late Paleo-Indian subsistence strategies cannot be made until a more complete data base has been established, Frison (1978) suggests that a dichotomy exists between plains-oriented cultures (e.g., Frederick, Lusk) and foothills and mountain-oriented

cultures (e.g., the Pryor Stemmed complex). Based on evidence obtained from numerous excavations in Wyoming and adjacent states, Frison (1978) suggests that terminal Plains Paleo-Indian groups were oriented toward specialized bison procurement strategies. Conversely, Pryor Stemmed cultures and perhaps other foothills and mountain-oriented cultures (e.g., Lovell Constricted, Mummy Cave) largely depended upon deer and mountain sheep as well as upon wild plant resources for their subsistence.

The dichotomy in subsistence strategies employed by plains-oriented groups versus foothill and mountain-oriented groups had repercussions in associated settlement patterns. Plains-oriented groups were highly mobile because their livelihood depended upon the success of the hunt. Summers were spent on the open plains collecting edible plant foods and following bison herds. Winters presumably were spent in more protected locations (e.g., rockshelters, along streams, or in uplifted areas) that provided shelter from the elements. On the other hand, foothill and mountain-oriented groups were more dependent upon plant resources and therefore were less mobile. These groups practiced a more generalized hunting and gathering economy in the mountains during the summertime and moved to more protected rockshelters in the foothill zone during the winter.

There is no indication that the social organization of late Paleo-Indian groups was substantially different from that of earlier Folsom groups. Presumably, during most of the year, these people lived in small mobile bands consisting of a few nuclear or extended families. Band size and membership were flexible and undoubtedly fluctuated seasonally. For example, during winter months when food was scarce, the band might break up into smaller family units. Likewise, exploitation of plant resources could occur only during certain seasons of the year (generally late spring and early fall) and is best accomplished by small-sized groups rather than large multiband units. Conversely, during the fall of the year, when resources were more abundant, several bands might come together for communal bison kills (Frison 1978; Reher 1978; Reher and Frison 1980).

The earliest evidence for residential structures in the study area comes from the Hell Gap site (Irwin-Williams et al. 1973), where the Midland level (ca. 10,650 to 10,350 BP) produced two circular alignments of postholes. The smaller alignment is approximately 2 meters in diameter, while the larger is approximately 4 meters in diameter. The Agate Basin level (ca. 10,450 to 9950 BP) at the Hell Gap site also yielded possible evidence of structures. Here, three superimposed circular posthole alignments measuring approximately 2 meters in diameter were noted. A fourth possible structure at the Hell Gap site is associated with the Frederick complex level (8350 to 7950 BP) and is defined by a stone circle 2 meters in diameter, a feature that is reminiscent of later Plains Indian groups, who used stones to anchor hides covering a superstructure. The implications and importance of this apparent shift in dwelling construction have yet to be explored.

2.6.2.1.2 Archaic Period (ca. 7500-1500 BP)

2.6.2.1.2.1 Early Plains Archaic/Altithermal (ca. 7500-5000 BP)

The Early Plains Archaic period corresponds to the Altithermal episode, a long, warm climatic interval of low rainfall. Archaeologically, this period is marked by an abrupt change in projectile point styles from earlier Paleo-Indian lanceolate forms to those exhibiting side-notches. Side-notched points occurred throughout much of North America between approximately 7800 to 6000 BP and are represented in the study area by a number of types and complexes.

Within the ROI, sites assigned to the Early Archaic period include the Hell Gap site, which produced a radiocarbon date of 5830 BP from an Altithermal soil that contained several nondiagnostic artifacts. In Albany County, Wyoming, Horned Owl Cave (48-AB-305) is a rockshelter with pictographs that has a reported Altithermal level. Also in Albany County, in a small cave designated as Tina-Ann's Cave (48-AB-398), a small quantity of cultural material, which included an Early Archaic projectile point was noted near the entrance. The Patten Creek site (48-PL-68) in Platte County also dates from the Early Plains Archaic period.

In areas adjacent to the ROI, several recent surveys prompted by proposed coal mining projects have produced Early Plains Archaic side-notched projectile points within the eastern Powder River Basin. Zier (1981) reports two sites with Early Archaic points from the Black Thunder Mine area, and Tibesar et al. (1981) report an Early Archaic site from Rochelle Mine.

Additional Early Plains Archaic components are represented at rockshelter and cave sites in the Big Horn and Absaroka Mountains. For example, Mummy Cave has produced dates that range from 7630 to 5250 BP, Southsider Cave has Early Archaic occupations ranging from 7650 to 5420 BP, and the Laddie Creek site has produced Early Archaic dates ranging from 6820 to 5700 BP. Elsewhere, radiocarbon dates from sites containing Early Archaic components range from 7685 BP at Pretty Creek Cave, Montana, to 4820 BP at Paint Rock V and 4430 BP at Carter Lake, Wyoming (Frison 1978). Reher (1979) also mentions that amateur excavations at rockshelters in Johnson County, Wyoming, have produced Early Archaic components. Two sites representing occupation of the basin environment during this period are the Dunlap-McMurray site near Casper, Wyoming, which may represent specialized utilization of plant resources during the spring, and the Shoreline site located in south-central Wyoming along the North Platte River, where evidence for possible house structures occurs. Early Plains Archaic-type points in amateur collections were obtained from surface contexts in basin areas (Shaw 1980), indicating that these areas were used to some extent during this time period.

Although large side-notched projectile points are the most common point type on the Wyoming Plains dating to the Early Plains Archaic period, Frison (1978) notes that large corner-notched points have been recovered from Mummy Cave and other rockshelters in the Big Horn Mountains. These corner-notched point types, which date between 7600 BP at Mummy Cave and 6000 BP at Laddie Creek, are similar to Elko series points (8000 BP to historic times) from the Great Basin (Holmer 1980, 1981). Unfortunately, the long time span of Elko series points pronibits their use as timemarkers.

Logan Creek Complex. The Logan Creek complex is named for a site in northeast Nebraska. Sites attributable to this complex or closely related to it are found scattered over much of Nebraska, appearing to be most common in roughly the eastern half of the state. The side-notched tradition of the Northwestern and Central Plains may be derived from this complex as well as from other eastern sources (Husted 1969). Logan Creek sites include such features as hearths, pits, small shallow basins, and a few postmolds. Bison bones occur in greatest frequency, but faunal remains of other large and small mammals, as well as freshwater mussel shells, are noted.

The westernmost Logan Creek complex site for which reliable data are available is the Spring Creek site in Frontier County, radiocarbon dated to 5860 BP. Site 25-KM-4, situated in southwest Nebraska in the study area (Figure 2.6.2-3), is believed to date somewhat later than this complex. Surface collections recovered generalized side-notched points that may be related to the Bitterroot and/or Salmon River types (Carlson and Steinacher 1978).

Hawken Side-notched Points. The Hawken site and the Hawken III site, both located on the western slope of the Black Hills in Wyoming, consist of a series of arroyo bison traps and kills. Radiocarbon dated to 6470 and 6270 BP, these sites attest to the continuation of bison herd exploitation during the Altithermal (Frison 1978).

Recovered from the Hawken site were large triangular, side-notched projectile points with straight to slightly concave bases. Frison (1978) notes that Hawken side-notched points show affinities to Logan Creek types (Kivett 1962) or Simonsen side-notched points (Agogino and Frankforter 1960; Shutler and Anderson 1974; Anderson and Semken 1980) of the Plains Prairie Peninsula to the east and to Bitterroot (Swanson et al. 1964) or Northern side-notched points (Jennings et al. 1980) of the Great Basin to the west, suggesting that early side-notched points on the Plains may have relationships elsewhere rather than being a local innovation.

Mt. Albion Complex. Benedict (1978) defines the Mt. Albion complex based on the presence of Mt. Albion corner-notched projectile points, which are described as medium-sized with shallow corner or side notches, expanding stems, and convex bases. Basal and notch grinding usually is heavy, and evidence of secondary use as butchering tools generally is exhibited. Representative tools of the Mt. Albion complex include stemmed knives, ovoid knives, bifacial and unifacial knives, perforators, gouges, gravers, spokeshaves, endscrapers, triangular scrapers, bifacial and unifacial scrapers/knives, utilized cores, milling stones, handstones, and a variety of debitage from tool manufacture and rejuvenation.

The complex is known from two excavated sites in the Colorado Front Range, surface collections from a number of high-altitude sites, and excavations at four rockshelters in or near the foothills. One of these, the Wilbur-Thomas Shelter (5-WL-45), is situated within the ROI. Two additional sites within the ROI assigned to the Mt. Albion Complex are 5-LR-109 and 5-LR-267, lithic scatters situated to the north of Table Mountain in Larimer County, Colorado. Seven radiocarbon dates from Mt. Albion occupations cluster between 5800 and 5350 BP.

The Mt. Albion complex is represented by a variety of site types in the mountains and foothills. High-altitude types include hunting sites (often associated with game-drive systems and hunting blinds), butchering and

Key to Figure 2.6.2-3

Selected Early Plains Archaic Sites

Unassigned Early Archaic Sites

1. Hawken
2. Mummy Cave
3. Laddie Creek
4. Pretty Creek Cave
5. Paint Rock V
6. Carter Cave
7. Hell Gap
8. Wilbur-Thomas
9. Laramie Lady
10. Horned Owl Cave
11. Tina-Ann's Cave
12. Guerrier Hearth

Logan Creek Complex

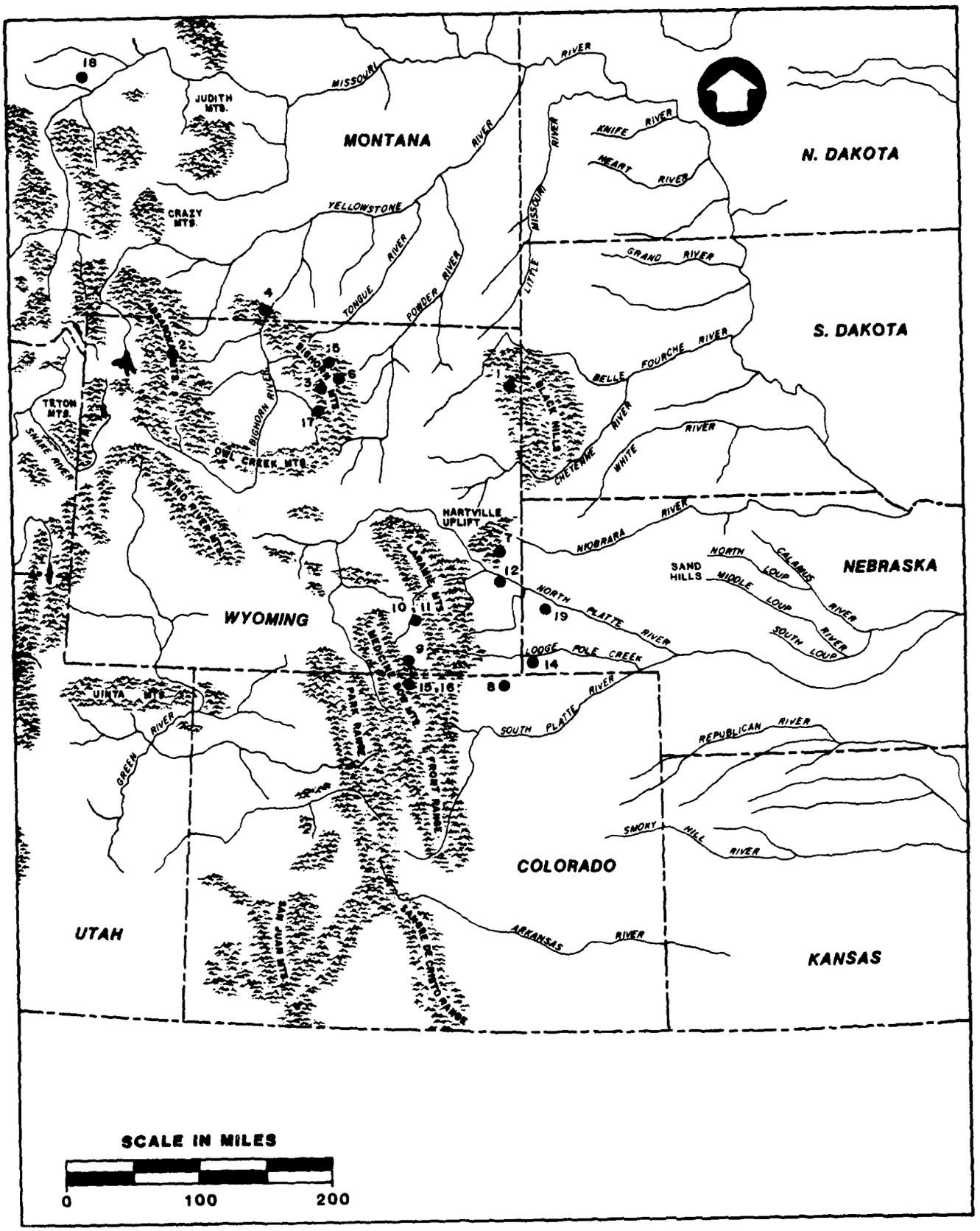
13. Spring Creek (not Mapped)
14. 25-KM-4

Mt. Albion Complex

8. Wilbur-Thomas
15. 5-LR-267
16. 5-LR-109

Oxbow Complex

2. Mummy Cave
17. Southsider Cave
18. Sun River
19. Signal Butte



SELECTED EARLY PLAINS ARCHAIC SITES

FIGURE NO. 2.6.2-3

processing sites, and open campsites. Sites from the foothills largely consist of open campsites and rockshelters. Although the season of occupation for most such sites has yet to be determined, it is assumed that high-altitude loci were occupied between late spring and early fall and that those in the foothills were occupied during the remainder of the year.

Despite the number of excavated sites attributed to the Mt. Albion complex, relatively little is known about indigenous subsistence. The preferred game appear to have been elk and mountain sheep; however, bison continued to be taken. The number of handstones and milling stones recovered from camps and rockshelters in the foothills implies that plant processing played an important role in subsistence activities. The types of plants exploited, however, are unknown.

Virtually nothing is known about the social organization of these people. As with other hunters and gatherers, it is assumed that they lived in small bands, comprised of several nuclear or extended families.

Oxbow Complex. Towards the end of the Early Plains Archaic period, a new projectile point style, known as the Oxbow point, appeared on the Northwestern Plains. Reeves (1973) and Frison (1978) suggest that the Oxbow complex developed out of the Early Plains Archaic side-notched tradition and may have been ancestral to the subsequent McKean complex. The Oxbow complex (ca. 5200 to 4000 BP) is contemporaneous with terminal Early Plains Archaic and early Middle Plains Archaic cultures. The occurrence of Oxbow points at sites in Wyoming, Montana, and the southern Canadian Plains has prompted both Reeves and Frison to suggest that a close and perhaps long-lived relationship existed between the people of the Northern and Northwestern Plains.

Distributional and temporal data suggest that the Oxbow complex developed in the southern Canadian Plains and gradually moved southward. Oxbow components have been reported from several sites in southern Saskatchewan and Alberta that range in time from approximately 5200 to 4000 BP. The recently excavated Sun River site near Great Falls, Montana, produced slightly earlier but overlapping dates. Frison (1978) reports that several cave sites in northeast and northwest Wyoming produced Oxbow projectile points and radiocarbon dates similar to those from Sun River. A few Oxbow-like points also were discovered in the lowest levels at the Signal Butte site (25-SF-1) (Strong 1935), which is found within the ROI.

The tool assemblage of the Oxbow complex is comparable to that noted for earlier cultural complexes, and an examination of these tools indicates little change in morphology or function from preceding complexes.

Subsistence strategies among Oxbow groups are poorly documented. Bison seem to have been the preferred game, but deer and antelope also have been reported. Direct evidence of plant use is lacking but is inferred on the basis of groundstone tools. Wormington and Forbis (1965) suggest that these people practiced a broad-based hunting and gathering economy brought with them from the prairie-woodland border to the east; however, current data are insufficient to test this hypothesis. Recent investigations at the Sun River site in Montana may contribute valuable information regarding subsistence practices among Oxbow people.

Wormington and Forbis (1965) note that Oxbow sites are located along stream valleys or in areas peripheral to short-grass plains. They suggest that this

patterning reflects orientation to Eastern Archaic subsistence-settlement modes; however, testing of such an hypothesis will require a more complete data base.

Discussion. The paucity of Early Plains Archaic sites in the heartland of the Northwestern Plains has prompted some archaeologists (e.g., Mulloy 1958; Benedict 1978; Frison 1978; Greiser 1980) to suggest that a cultural hiatus existed in this area during the Early Archaic that coincides with the Altithermal, or Atlantic II-IV, climatic episode (7730 to 4680 BP) (Bryson et al. 1970). Archaeologists supporting the cultural hiatus hypothesis maintain that abandonment of the Plains was a result of climatic and environmental deterioration that resulted in reduced forage and carrying capacity for large herbivores. In response to these changes, bison and other game animals migrated to areas of greater topographic relief peripheral to the Northwestern Plains (e.g., the Big Horn Mountains, the Black Hills, or the Hartville Uplift area), where increased environmental diversity provided animals and man with a more suitable environment. Proponents of this hypothesis conclude that the occurrence of known sites in such peripheral and oasis areas and the absence of sites from the Plains interior support their theory.

Others, however, assert that the absence of sites from the Plains interior during this period is not the result of a cultural hiatus but, rather, a consequence of inadequate archaeological sampling (Shaw 1980), factors of geologic preservation (Reeves 1973), and the difficulty of identifying tools from this period (Frison 1978).

In peripheral areas, side-notched projectile points of the Early Plains Archaic period have been improperly identified as Late Plains Archaic points. Consequently, some sites recorded as Late Plains Archaic may actually be Early Plains Archaic in age (Frison 1978).

Reeves' (1973) contention concerning geologic preservation is especially pertinent to the discussion of a Northwestern Plains cultural hiatus during the Early Plains Archaic period. He suggests that sites from floodplain surfaces either were destroyed by degradation or were deeply buried by subsequent stream aggradation during the Atlantic Climatic episode. Reeves further argues that the lack of stable landforms in the Plains interior during the Atlantic episode contributed to the paucity of information from this period.

Because the climate of the Altithermal resulted in a reduction of bison populations, Early Plains Archaic peoples were forced to adopt a more generalized hunting and collecting economy. Bison were relegated to a lesser role in the economy than perhaps at any other time in the prehistory of the Plains. Mountain-adapted species (e.g., deer, elk, and mountain sheep) were more dependable resources (Shaw 1980). Other small game were utilized more frequently and, presumably, plant resources became more important. The increased role of plants in the diet of Early Archaic peoples is inferred primarily from increased numbers of groundstone tools, roasting pits, and storage pits.

The distribution of Early Plains Archaic sites in Wyoming indicates a differential distribution between sites from the foothills and mountains versus sites from interior basins and open plains. For northeast Wyoming, Frison (1978) mentions only 3 Early Archaic sites, whereas 12 sites are listed for the Big Horn Mountains of Wyoming and Montana. Similar site distributions

have been noted by Greiser (1980) for the Central Plains and by Benedict (1978) for the Plains in general, and Colorado in particular. Greiser (1980) has suggested that observed changes in settlement pattern in the Central Plains are the result of shifts in territorial centers to ecotonal areas that supported greater environmental diversity (e.g., foothills and mountains). Such a shift to the eastern and western peripheries of the Plains would account for observed site distributions. Frison (1978) maintains that a shift in the use of environmental zones to higher elevations also can be substantiated for Wyoming on the basis of current data.

An alternative explanation for Early Plains Archaic settlement patterns is that rockshelter and cave sites represent late fall to early spring occupations and that open sites on the Plains represent spring-fall occupation. The distribution of game would have made the lower foothills the most strategic location for winter camps (Shaw 1980). Unfortunately, the season(s) of occupation for many cave sites has not been established, and, as noted previously, the paucity of sites from the open plains has restricted knowledge of Early Plains Archaic culture. To date, Early Archaic settlement patterns and adaptive strategies are poorly known, and consequently, the above models remain untested.

The scarcity of information from the Early Plains Archaic period does not allow detailed inferences about social organization. Presumably, people still were organized into small, highly mobile bands. Evidence from the Colorado Front Range indicates that large game were hunted using drive lines and trapping techniques at high altitudes during the Altithermal, and Shaw (1980) proposes that special activity groups could have moved to the Bighorn Basin periphery for short periods during the late spring to collect and process plants. Greiser (1980) suggests that the duration, size, and number of occurrences of band aggregations during the seasonal round were reduced as a result of changes in subsistence patterns. During the subsequent Middle Plains Archaic period, many of the social, economic, technological, and cultural changes associated with climatic and environmental deterioration during the Altithermal were retained and, in some cases, elaborated upon.

2.6.2.1.2.2 Middle Plains Archaic (ca. 5000-3000 BP)

The Middle Plains Archaic period is marked by the sudden florescence of the McKean complex. Diagnostic artifacts of this complex include the McKean projectile point and its variants (i.e., Duncan, Hanna, Mallory, and Yonkee). Based on data obtained from several sites in northwest Wyoming, Frison (1978:45) states that "Mummy Cave, Dead Indian Creek site, and Southsider Cave materials suggest a continuity in projectile point styles at least from the Early Plains Archaic into McKean or Middle Plains Archaic." Reeves (1973) postulates that the Oxbow Complex is transitional to, and overlaps with, the McKean Complex. Other sites suggest Oxbow-McKean mixing.

As Frison (1978) notes, the controversy over the use of the term "McKean" continues to plague archaeologists. The McKean site, a campsite in northeast Wyoming, produced a wide range of projectile points that Mulloy (1954b) considers to be variations upon a single point type. Archaeologists like Wheeler (1954), who worked at McKean complex sites in the same area, recognize separate projectile point types (e.g., Duncan and Hanna). Several hypotheses have been offered to explain differences in projectile point styles. These include differences attributed to function, raw material, time period, and

cultural distribution, but "no model yet proposed to accommodate these disparate styles has offered any real solutions" (Frison 1978:49).

The "true" McKean point is a lanceolate blade with an indented base and convex blade edges. Duncan and Hanna points closely resemble the McKean point in blade dimensions but display notable variations in stem morphology. Duncan points are stemmed with sloping shoulders, while Hanna points have distinct shoulders and slightly expanding stems. Another McKean variant is the Mallory point, which has deep side-notches, a wide, thin blade, and a concave to deeply indented base. Mallory points appear to have an extremely wide distribution. The final point type that may be related to the McKean projectile point is the Yonkee point (Frison 1978). Yonkee points are triangular in outline, usually side-notched (or occasionally corner-notched), and have deep basal notches or indentations.

Radiocarbon dates for McKean complex sites range between ca. 5000 and 3000 BP (Frison 1978); the earliest dates come from the Big Horn Mountains and the most recent dates from the Powder River Basin. The McKean site, however, failed to produce a radiocarbon date. Wheeler (1954) defined the Duncan and Hanna projectile point types from materials recovered in the Belle and Mule Creek rockshelters near the McKean site. Miller's (1976) study of radiocarbon dates on the Northern Plains seems to indicate a regional expansion of McKean occupation from the higher elevations in and around the Rocky Mountains eastward into areas along tributaries of the major river drainages of the Plains. This supports Syms' (1969) earlier contention that such an expansion occurred.

The number of known sites on the open plains and in interior basins increases dramatically during this period. Open campsites or rockshelters dating from this period have been excavated in the Powder River Basin, the Bighorn Basin and mountains, the Laramie Basin, and Green River Basin in Wyoming as well as in the foothills of Colorado and the western Nebraska Panhandle. A great deal of similarity exists in artifactual content and cultural adaptation between the southeast part of the Northwestern Plains and the northern part of the Western Plains (Wood 1967).

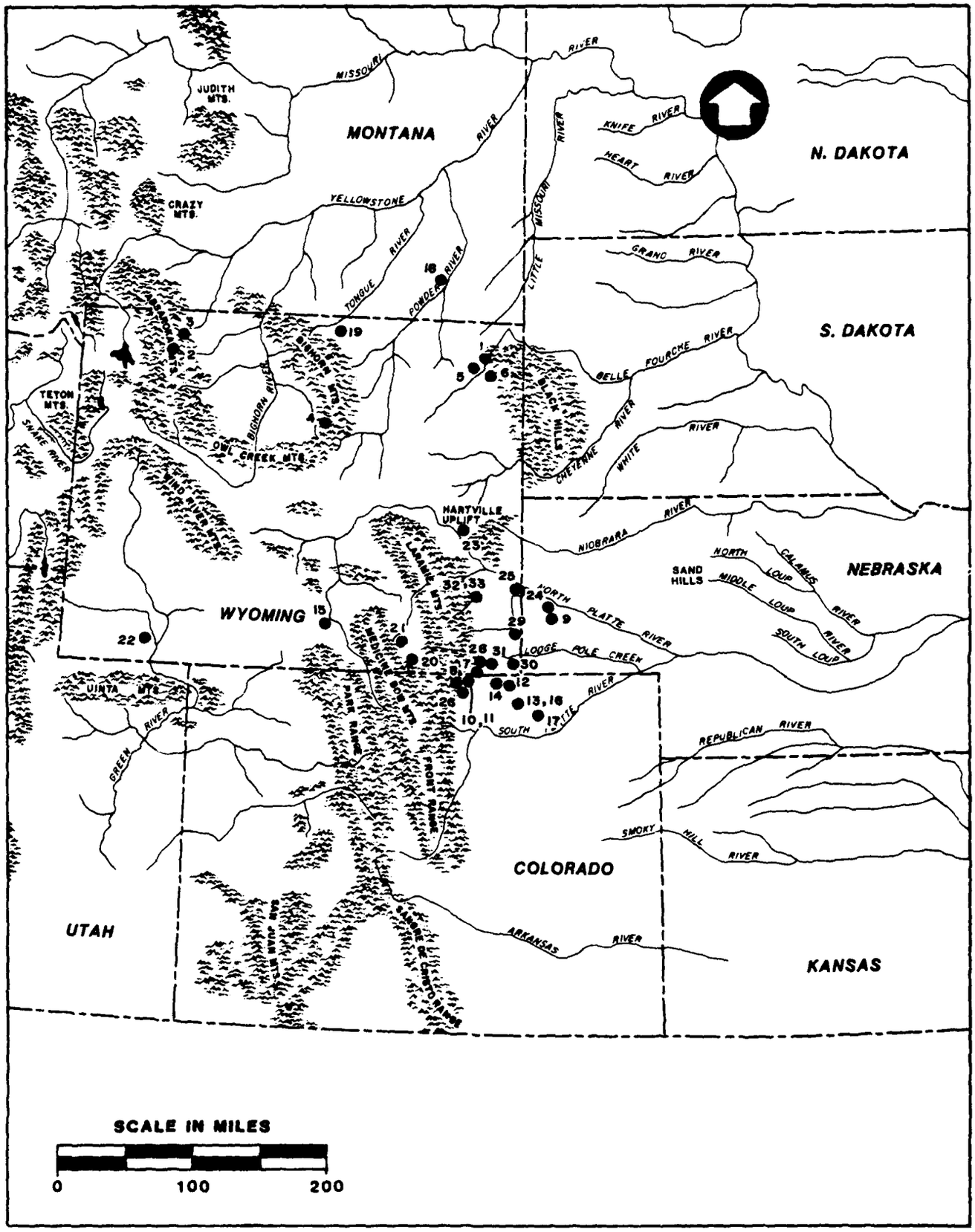
Several sites in the study area have produced materials associated with the McKean complex. Level 3 of site 5-WL-40, near west Stoneham, Colorado, yielded a complete Hanna Point (Wood 1967). The Wilbur-Thomas Shelter (5-WL-45) produced a McKean complex level, but no radiocarbon dates were obtained. The Spring Gulch site (5-LR-252), an open campsite in extreme north-central Colorado, produced a variety of McKean complex projectile points dated to approximately 3100 BP. Additional Middle Plains Archaic sites in the ROI portion of Colorado include the Lindenmeier site (5-LR-13) and the Johnson site (5-LR-26), plus others in both Larimer and Weld counties.

Numerous sites also are recorded in the ROI in Wyoming and Nebraska, including campsites, lithic scatters, tipi rings, a rockshelter, and a quarry site (Figure 2.6.2-4). McKean point types are one of the more consistent surface finds in eastern Wyoming (Reher 1982). Regular use of the Willow Springs Bison Pound (48-AB-130) occurred during the Middle Archaic period and continued into early historic times. Six years of excavation by the University of Wyoming at this location recovered evidence of environmental continuity and cultural change in the southern Laramie Basin (Bupp 1981). Signal Butte I, situated in southwest Nebraska, contained McKean lanceolate points and large side-notched points. Radiocarbon samples associated with this level yielded dates of 4550 and 4170 BP (Bliss 1950).

Key to Figure 2.6.2-4

Selected Middle Plains Archaic Sites

1. McKean
2. Mummy Cave
3. Dead Indian Creek
4. Southsider Cave
5. Belle Rockshelter
6. Mule Creek Rockshelter
7. Lindenmeier
8. Johnson
9. Sheep Mountain
10. 5-LR-261
11. 5-LR-105
12. 5-WL-406
13. 5-WL-358
14. Wilber-Thomas
15. Scoggin
16. 5-WL-367
17. 5-WL-40
18. Powers - Yonkee
19. Mavrakis - Bentzen Roberts
20. Willow Springs Bison Pound
21. Fatto's Fabulous Forty
22. Pine Spring
23. 48-GO-2
24. Signal Butte I
25. 48-GO-174
26. Spring Gulch
27. Albion Boardinghouse (not mapped)
28. 48-LA-222
29. 48-LA-237
30. Seven Mile Point
31. 48-LA-459
32. Graves Ranch
33. 48-PL-97



SELECTED MIDDLE PLAINS ARCHAIC SITES

FIGURE NO. 2.6.2-4

The spatial and temporal distribution of sites producing Yonkee projectile points (a McKean variant) is greatly restricted when compared to sites yielding McKean points. Yonkee sites spatially are confined to the Powder River Basin of Wyoming and southern Montana. Temporally, they range from 4450 BP at the Powers-Yonkee site (Bentzen 1961) to 2600 to 2460 BP at the Mavrakis-Bentzen-Roberts site (Bentzen 1961, 1962). Other dated Yonkee or Yonkee-like sites include 48-SH-312 (2910 BP), a bison kill site along the Powder River in Wyoming (Frison 1968), and the Cordvero Mine Site (3500 BP), a bison processing campsite along the Belle Fourche River south of Gilette, Wyoming (Reher et al. 1978). The persistence of Yonkee points for nearly 500 years beyond the termination of the Middle Plains Archaic period may indicate that these people continued as a viable cultural group until almost 2450 BP. As Frison (1978) notes, however, the relationship between Yonkee manifestations and the McKean complex needs clarification.

Unlike the narrowly defined Yonkee manifestations, Mallory points have broad spatial and temporal distributions. Benedict (1979) describes Mallory-like points from the Albion Boardinghouse site, a high-altitude campsite west of Denver; a radiocarbon date of 5730 BP was obtained from this locality. Benedict (1979) ascribes this site and similar materials from surface collections along the Colorado Front Range to the Albion Boardinghouse complex. Elsewhere, Mallory points have been recovered from the Great Basin at Sudden Shelter (Jennings et al. 1980), the Colorado Plateau, and in the Wyoming Basin at the Scoggin and Pine Spring sites (Sharrock 1966; Lobdell 1973). Mallory points also were recovered from the Sheep Mountain site (25-BN-1), a butte-top site (Carlson and Steinacher 1978), as well as at the Spring Gulch site (5-LR-255) in Colorado (Morris et al. 1979). Because these sites date between 4670 and 3650 BP, Benedict (1979) suggests that the point style developed in the Colorado Front Range and then spread to the north, east, and west at the end of the Atlantic Climatic episode.

Chipped stone tools other than projectile points in the McKean complex toolkit (e.g., various types of scrapers, knives, drills, flake tools) show no appreciable change from earlier assemblages. The number and variety of sandstone manos and milling slabs increase during the Middle Plains Archaic period, but, according to Frison (1978:49) "they are not as reliable as projectile points as chronological markers because they span several thousand years of time with no discernible changes in style." A variety of bone artifacts also are characteristic of the Middle Plains Archaic period (e.g., game counters and beads).

Subsistence data recovered from McKean sites in Wyoming and adjacent states indicate that these people followed a broad-based hunting and gathering economy. Although faunal remains include bison, deer, antelope, rabbit, and other small mammals, a dramatic increase in plant-processing tools and features (e.g., handstones and milling stones, roasting pits, fire hearths, and storage pits) attests to the important role that vegetal resources played in the economy. Increased reliance on plant foods may have altered settlement patterns due to changed requirements in the seasonal scheduling of resource exploitation.

Frison (1978) has proposed a model of seasonally based movement for the Big Horn Basin area in which cultural groups typically crosscut several environmental zones in their seasonal round between the desert basin and mountain slopes. Elevational differences between these two zones would have allowed cultural groups to follow maturing resources upslope without having to

move great distances. Although this model was designed specifically for the eastern Big Horn Basin and western slopes of the Big Horn Mountains, it also may be applicable to areas east of the Continental Divide and adjacent plains. On the other hand, subsistence strategies for groups living away from the mountain front on the High Plains may have been quite different. Groups living on the High Plains would not have had the luxury of the kind of tightly compacted environmental niches provided by adjacent mountain slopes, nor would they have had the diversity of floral and faunal resources to exploit. Reher (1979) has proposed that bison procurement, in conjunction with the collection of available plant foods, were the principal subsistence activities of groups living in the eastern Powder River area. If this is the case, then presumably both bison and humans would have moved onto the High Plains from late spring to early fall and then moved to more sheltered areas with greater environmental diversity (e.g., the Black Hills and Hartville Uplift areas) during the late fall to early spring.

Although increased reliance on plant resources has been inferred from abundant groundstone tools and roasting pits associated with McKean-age sites, little is known about the specifics of vegetal resource scheduling and procurement strategies. Conversely, bison procurement strategies during the Middle Plains Archaic period are quite well documented. Apparently, arroyo traps continued to be the preferred method of bison procurement; however, bison jumps and corrals also are known.

Several arroyo traps associated with Yonkee occupations have been excavated in the Powder River Basin. Collectively, the data recovered from these sites suggest that (Frison 1978:210):

- The arroyo trap method of hunting remained essentially unchanged from the Paleo-Indian and Early Plains Archaic periods;
- Kills represent communal hunts occurring primarily during the late fall or early winter; and
- Stripping of meat from articulated bones was directed toward the single purpose of drying and storing it for the winter.

Evidence from the Scoggin site north of Rawlins, Wyoming, indicates that bison pounds or corrals were in use by about 4450 BP. Projectile points from the site were identified as McKean lanceolate and Mallory side-notched (Lobdell 1973). Excavations at the site revealed that a series of postholes and connecting stone walls lay at the base of a steep talus slope. Presumably, bison were driven over the talus slope and trapped within the corral-like structure.

Resource procurement scheduling is believed to have been an important factor in determining settlement patterns, fluctuations in group size, and territoriality during the Middle Plains Archaic period. More sites and site types from varied ecological settings are known from this time than from any preceding cultural period. Despite the increased data base, however, the season(s) of occupation at most of these sites is not known. Consequently, elucidation of the indigenous economic system must await further study.

Based on available subsistence and settlement data, Greiser (1980) postulates that cultural groups segregated into extended families between late spring and late summer-early fall and located their sites near reliable plant

resources. During the fall, bands congregated to exploit the more plentiful resources available at this time of the year and to prepare food for storage for the coming winter. With the onset of winter, these bands broke up into smaller units and moved to more sheltered areas. Frison (1968) notes that evidence indicates that the early Middle Archaic period type of bison kill operation would not require the amount of communal cooperation necessary for drives characteristic of later periods. From the Powder River site it appears that four or five males of an extended family group would have been able to carry out such hunts.

The sudden florescence of Middle Archaic sites on the open plains has been interpreted by some archaeologists as indicating a population increase. Greiser (1980) speculates that an increase in population during the Middle Archaic period resulted in increased territoriality. Frison (1978), Reher (1979), Greiser (1980) have noted an increase in the number of sites (especially stone circles) located on buttes and ridgetops in areas of broken terrain. Not only would these sites have provided ready access to a variety of resources, but also they could have been used for defensive purposes. Mulloy (1965) states that Middle Archaic period sites tend to be larger in size than those dating from earlier or later periods. He feels that this difference reflects extensive re-use of particular site locations rather than increased group size. Beginning with this period, and continuing through the Late Prehistoric period, large numbers of stone circles occur on the Plains. They occur in diverse environmental settings and in various diameters and shapes, singly or in groups. Evidence argues for both domestic and ceremonial functions for these features (Malouf 1960; Mulloy 1960; Frison 1978).

2.6.2.1.2.3 Late Plains Archaic (ca. 3000-1500 BP)

The Late Plains Archaic period is represented in the ROI by at least three cultural complexes: the Pelican Lake complex, the Gering Mortuary complex, and the Besant complex.

Pelican Lake complex. The Pelican Lake complex is characterized by corner-notched projectile points with straight bases and pronounced barbs. The morphology of these points contrasts sharply with earlier McKean complex point types. The only named style is the Pelican Lake corner-notched point that, according to Frison (1978), also is the earliest corner-notched variety. Further work is needed, however, to clarify the diversity of corner-notched points that abound at this time.

Pelican Lake points were defined first by Wettlaufer (1955) in south-central Saskatchewan and later by Wettlaufer and Mayer-Oakes (1960) in extreme southeast Saskatchewan. The earliest dates for the Late Plains Archaic period (ca. 3550 to 3300 BP) were obtained from three stone circle sites in the Shoshone Basin of northwest Wyoming and the upper levels at the McKean site (Mulloy 1954a,b). Frison (1978) questions the validity of these dates and suggests that the Pelican Lake complex began about 3050 to 2950 BP. On the other hand, Reeves (1970) believes that the Pelican Lake complex dates to between 2950 and 1750 BP.

Several Pelican Lake occupations are documented in the study area (Figure 2.6.2-5). In western Nebraska, these materials have been reported from the Signal Butte II occupation (25-SF-1) (Strong 1935), where a radiocarbon date of 2650 BP was obtained (Frison 1978). The earliest occupations at the Happy

Hollow Rockshelter (5-WL-101), located just south of the Wyoming/Colorado border, produced Pelican Lake projectile points (Steege 1967). Radiocarbon samples from hearths associated with these points yielded dates of 2680 and 2170 BP (Steege 1967). Mulloy (1965) reports a Pelican Lake occupation along the North Platte River near Glendo, Wyoming, where a large stone circle site (48-PL-23) produced Pelican Lake projectile points in association with a hearth dated at 2020 BP.

Pelican Lake points are common throughout adjacent parts of Wyoming, particularly in the Powder River Basin and the Big Horn Mountains. Based on data obtained from numerous cave and rockshelter sites in the Big Horn Basin and adjacent mountains, Frison (1978) and Reher (1979) suggest that Pelican Lake and other Late Plains Archaic corner-notched assemblages persisted longer in the Big Horn Mountains. The dates of occupation for many of these sites range between 1800 and 1500 BP. The lack of such materials from Magic Mountain (Irwin-Williams and Irwin 1966) and LoDaisKa (Irwin and Irwin 1959) suggests a possible cultural hiatus during the Pelican Lake time period in the southern portion of the Central Plains, but such an hypothesis will require further investigation before it can be substantiated.

A comparison of tool assemblages by Mulloy and Steege (1967) from Pelican Lake components in the Shoshone Basin, along the North Platte River, and at the McKean site indicates continuity with earlier McKean complexes and a high degree of homogeneity among sites of the Pelican Lake complex. Common tool types recovered from Pelican Lake occupations in Wyoming include biface knives, preforms, various end and sidescrapers, denticular scrapers, spokeshaves, gravers, drills, utilized flakes, retouched flakes, core tools, flake tools, choppers, hammerstones, handstones, and milling stones. In addition, several cave sites yielded a large, diverse collection of perishable materials, such as coiled baskets, bark cordage, sinew, hide, feathers, shell, and wood-working debris. The assemblage also includes corner-notched points bound by sinew to foreshafts, as well as mainshafts and atlatls.

The preponderance of bison bones recovered from archaeological sites dating to this period attests to a heavy reliance upon bison. At the same time, cultural groups on the open plains hunted deer, antelope, rabbit, and other small game; mountain sheep were an important source of protein for groups living near mountainous areas. Frison (1978) points out that bison procurement strategies remained essentially unchanged during the early Late Plains Archaic (i.e., Pelican Lake) and included arroyo traps and jumps, with communal kills occurring during the late fall-early winter.

The continued presence of groundstone tools and roasting and storage pits indicates that exploitation of plant resources remained an important aspect of the seasonal round. In fact, Mulloy (1965) suggests that the lack of animal bones and the high incidence of groundstone tools and roasting pits from sites along the North Platte River, the Shoshone Basin, and the upper levels at the McKean site are indicative of a plant-oriented diet. Evidence recently obtained from the Powder River Basin (Greiser et al. 1982) tends to support his hypothesis. Pollen and macrofloral evidence and the general paucity of bones from these sites indicate that processing of various berries, roots, tubers, seeds, and nuts was a predominant activity in the area. Nevertheless, the presence of projectile points, knives, and scrapers from most of these sites strongly suggests that hunting and hide processing activities also took place. Thus, as Greiser et al. (1982) and Mulloy (1965) point out, these data may indicate seasonal scheduling of resource procurement. Evidence from

Key to Figure 2.6.2-5

Selected Late Plains Archaic Sites

Pelican Lake

1. Signal Butte
2. Happy Hollow Rockshelter
3. McKean
4. Antelope Creek Sites
5. Big Horn Caves
6. North Platte River Sites (48-PL-23)
7. North Antelope
8. Shoshone Basin

Gering Mortuary

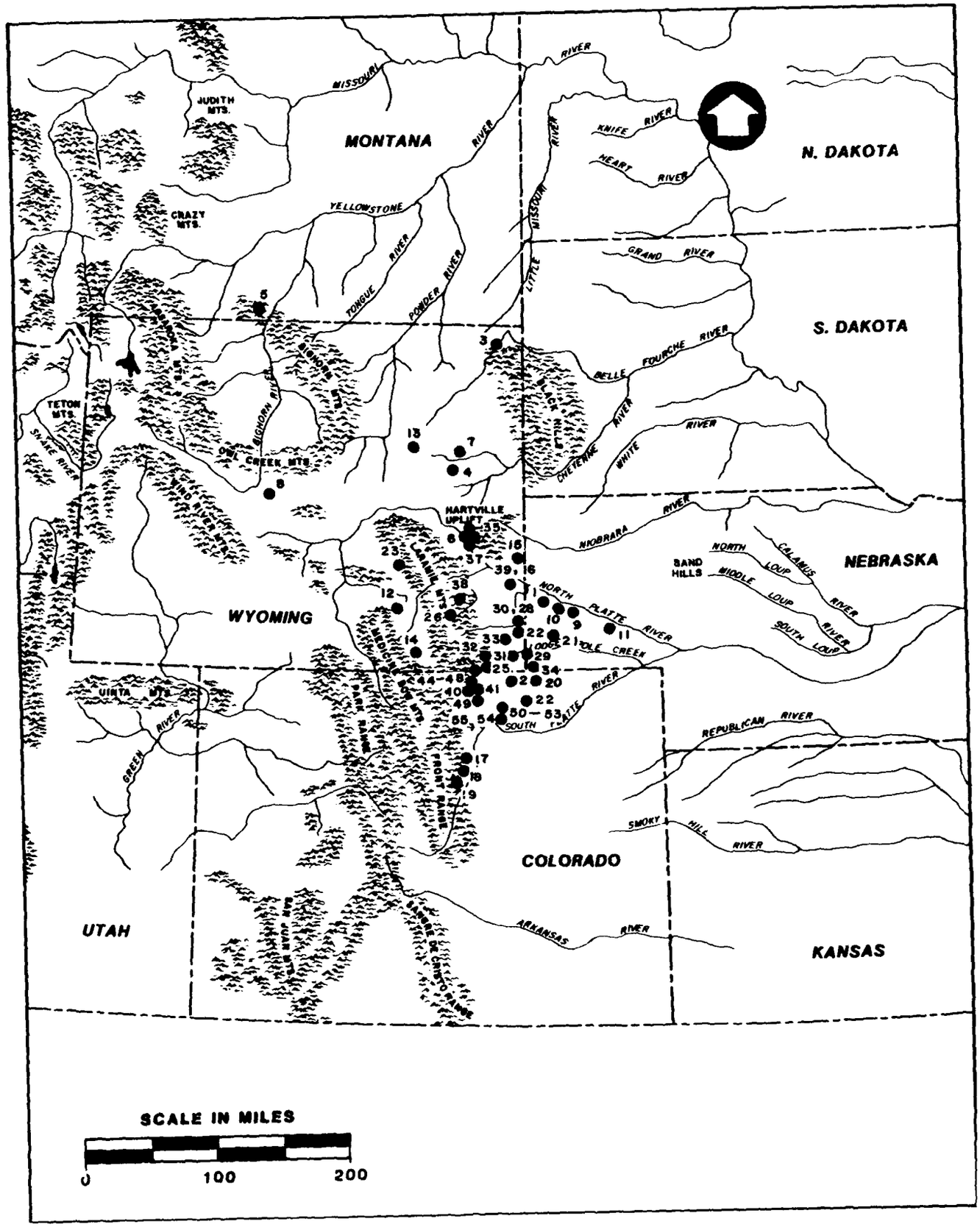
9. Gering Burial
10. Bisterfeldt Site

Besant

1. Signal Butte
2. Happy Hollow Rockshelter
3. Mc Kean
4. Antelope Creek Sites
6. North Platte River Sites
7. North Antelope Sites
8. Shoshone Basin Sites
11. W. Nebraska Rockshelters
12. Muddy Creek
13. Ruby
14. Willow Spring Bison Pound
15. 48-GO-179
16. Greyrocks

Unassigned Late Archaic Sites

17. Bidder Creek
18. Magic Mountain
19. Willow Brook
20. Uhl
21. White Stone Butte
22. Keota Stone Circles
23. Bell Cave
24. Huntley Burial (not mapped)
25. Reese Ranch
26. 48-LA-213
27. 48-LA-232
28. 48-LA-233
29. 48-LA-235
30. 48-LA-237
31. 48-LA-238
32. C.P. Organ
33. Petsch Springs
34. Seven Mile Point
35. 48-PL-21
36. 48-PL-29
37. 48-PL-53
38. Graves Ranch
39. 48-PL-308
40. Spring Gulch
41. 5-LR-297
42. 5-LR-267
43. 5-LR-265
44. 5-LR-264
45. Lykins Valley
46. 5-LR-262
47. 5-LR-260
48. 5-LR-257
49. Owl Canyon Rockshelter
50. 5-WL-356
51. 5-WL-354
52. 5-WL-383
53. 5-WL-382
54. 5-WL-377
55. 5-WL-364



SELECTED LATE PLAINS ARCHAIC SITES

FIGURE NO 2.6.2-5

northeast Wyoming (Mulloy 1965; Reher 1979; Greiser et al. 1982) suggests that plant processing in interior basins occurred between late spring and early fall and that communal bison kills frequently took place during the late fall-early winter. Rockshelter sites and sites in protected areas or along major drainages appear to have been occupied from late winter to early or late spring.

Although data on settlement patterns during the Pelican Lake period are scarce, the distribution of Pelican Lake sites is similar to that for the preceding McKean complex. Not only are they found in similar geomorphic settings (e.g., upland and lowland areas, open plains, stream terraces, sand dunes, and rockshelters), but also many stratified sites indicate occupation by both McKean and Pelican Lake populations. Pelican Lake sites, like McKean sites, include lithic scatters, open camps (with and without stone circles and/or hearths), rockshelters, bison kills, food processing sites, and quarry sites. McKean sites are, however, slightly more numerous than Pelican Lake sites. This may be due to the extended time period of the McKean complex and/or to geologic factors of preservation rather than to decreased population density.

If the aforementioned subsistence-settlement system holds, then it is reasonable to assume that cultural groups continued to live in highly mobile bands. If so, then it also follows that group size and membership were flexible and coordinated seasonally for efficient handling of the dominant exploitative tasks engaged in by band members. For example, during the late winter and early spring, when food was scarce, bands segregated into small extended-family or single-family units. Conversely, during the late summer to early winter, several bands may have congregated for communal bison hunts, plant collecting, and food processing for the winter as well as for various social and religious reasons. A more precise delineation of group territoriality, trade or interaction networks, and estimated population densities must await further research.

Gering Mortuary. From about 2450-1450 BP, the Gering Mortuary complex was present in western Nebraska, with similar material discovered in northeast Colorado. Sites representative of this period in the ROI are the Gering Burial (25-SF-10) and the Bisterfeldt site (25-SF-3). Burials at these sites occur in natural low rises and consist of both primary and secondary interments. Associated artifacts include tubular bone beads, marine shell beads and pendants, atlatl weights, various lithic tools, and occasional grinding stones. Red ochre also appears in some of the burials. Projectile points are generally medium-sized, stemmed, and display excurvate blade edges with a tendency towards basal notching (Carlson and Steinacher 1978). This complex may be related to the succeeding Plains Woodland complex (Breternitz and Wood 1965), it may be partly contemporaneous with Woodland groups farther to the east, or it may itself be a western-derived group arising out of one of the western Archaic complexes (Carlson and Steinacher 1978).

Besant Complex. A widespread Late Plains Archaic period cultural unit is the Besant complex. First defined by Wettlaufer (1955) at the Morlatch site (1580 BP) in south-central Saskatchewan, this complex is characterized by large, shallow side-notched projectile points with straight bases. The earliest dates for Besant have been reported by Reeves (1978) from the upper levels of the terminal Pelican Lake phase at the Head-Smashed-In Buffalo Jump in Alberta.

In Wyoming, Besant occupations are known from surface finds as well as from a variety of site types, including three communal bison kills. These kill sites, including the Ruby site (Frison 1971a), the Muddy Creek site (Frison 1978), and the Willow Springs site (48-AB-130) (Bupp 1981), as well as similar Besant kills outside of Wyoming, demonstrate a sophisticated bison procurement technique heretofore unknown on the Plains. In each case, the kill was associated with a corral-and-wing structure; bison were driven down a chute, trapped in a corral, and then killed. Two of the three Besant kill-sites (the Ruby site and the Muddy Creek site) produced three radiocarbon dates clustering between 1800 and 1650 BP (Frison 1978).

Mulloy (1954a,b, 1965) and Mulloy and Steege (1967) report Besant-like points from a number of stone circle sites and open camps. Similar points also were recovered from a number of sites along the North Platte River near Glendo, Wyoming; however, only the lower level at 48-PL-24, which is within the ROI, produced a radiocarbon date of Besant age (1525 BP) (Mulloy 1965). Mulloy (1965) and Mulloy and Steege (1967) compare materials from these sites to artifacts collected from sites in the Shoshone Basin (Mulloy 1954a) and the upper levels at the McKean site (Mulloy 1954b). Unfortunately, Besant occupations in the Shoshone Basin were not radiocarbon dated, and the date from the upper levels at the McKean site reflects the earlier Pelican Lake component.

Although the Besant complex is well represented on the Northwestern Plains, it is poorly known in the Central Plains; however, Strong (1935) and Bell and Cape (1936) report Besant-like points from rockshelters in western Nebraska. Unfortunately, these materials are mixed with earlier assemblages, and, consequently, the precise period of Besant occupation at these sites is unknown. Steege (1967) discovered a Besant-like point at the Happy Hollow Rockshelter (5-WL-101) in extreme northern Colorado, but the projectile point does not appear to be associated with any dated features at the site.

Johnson (1977:66) summarizes the Besant complex as follows:

> Besant was a migratory, bison-hunting plains cultural tradition that existed between approximately AD 100 and 700 on the plains of southern Alberta, Saskatchewan, Manitoba, northern Wyoming, Montana, and North and South Dakota. Characteristics of the Besant culture are shallowly side-notched atlatl points (frequently made of Knive River flint) with straight or slightly concave bases, campsites, buffalo jumps (or pounds), occasional pottery, house structures (now represented by post molds), and burial mounds. Besant possibly had its origin in an Eastern Woodlands culture.

An alternative explanation for the origin of the Besant complex has been offered by Perry (1980:288), who concludes that "the people responsible for the Besant complex were Athabascans who had adjusted their subsistence activities toward a greater emphasis on bison." The suggested relationship between the Besant complex and the Plains Woodland tradition, however, is far more compatible with the known archaeological record than Perry's Besant-Athabascan connection.

Aside from changes in dart projectile morphology and the construction of bison drive lanes and corrals, tool assemblages attributed to the Besant people

resemble those of the previous Pelican Lake complex. Hunting, butchering, and hide processing tools remain relatively unchanged, as do the groundstone tools generally associated with plant processing. Thus, the Besant tool kit includes projectile points, knives, bifaces, endscrapers and sidescrapers, spokeshaves, drills, gravers, utilized and retouched flakes, flake tools, choppers, hammerstones, a variety of bone tools, handstones, and milling stones.

Available evidence indicates that subsistence among Besant people remained relatively unchanged from the earlier Pelican Lake settlement-subsistence system. As noted above, the number of bison kill sites and the preponderance of bison remains from open campsites suggest that Besant people may have relied more on bison than had Pelican Lake groups. Nevertheless, deer, antelope, rabbit, birds, and rodents also were exploited. In addition, an abundance of groundstone tools, roasting pits, and other features associated with Besant occupations indicate that exploitation and use of plant resources continued to be a significant aspect of the indigenous subsistence system.

The most noteworthy distinction between Pelican Lake and Besant is the associated hunting strategies. During the early Late Plains Archaic period, bison exploitation practices included arroyo traps and jumps. Subsequent Besant bison hunting practices introduce corral-and-wing structures. The degree of organization required to construct and implement this latter method of bison procurement was far greater than previously practiced on the Plains. The best example of this new hunting strategy and its impact on social structure comes from the Ruby site (Frison 1971a, 1978), where excavations revealed that Besant hunters possessed the most sophisticated bison procurement methods ever documented on the Plains. These people not only utilized the topography to assist in the hunt, but also constructed various artificial structures (e.g., drive lanes, wing structures, bison corrals) to herd and impound the bison. These structures were rejuvenated as needed. Frison (1978) postulates that the mobilization of 20 males - presumably an entire social group - working 10 to 14 days would have been required to complete construction of these features. Although preparations for a drive were organized communally, processing and consumption of bison occurred at the family level. Finally, the presence of a religious structure adjacent to the corral (Frison 1971a, 1978) indicates that the relationship between successful hunting practices and religious beliefs has great antiquity on the Northwestern Plains.

Discussion. Data on settlement patterns and seasonal subsistence rounds during the terminal Late Plains Archaic period on the Central Plains are scarce. To date, there is no indication that they differed markedly from the preceding Pelican Lake complex. Besant site locations range from foothill environments to the open plains and semiarid desert basin environments and from open sites to caves and rockshelters. Available evidence suggests that open habitation sites on the Plains represent late spring through early fall occupations, while protected habitation sites in areas of broken terrain or along river valleys represent winter to late spring occupations. At the same time, the successful hunting strategies of the Besant people may have allowed them to congregate into larger groups and/or more frequently, but the age-old practice of dispersion-aggregation-dispersion apparently continued with little change into historic times.

Numerous sites attributed to the Late Plains Archaic period have been recorded in the ROI (Figure 2.6.2-5); however, the tribal affiliations of these sites

are unknown. The earliest component from the Uhl site (5-WL-32) yielded a radiocarbon age of 2170 to 1955 BP. A wide range of small game is represented in the faunal collection, and pronghorn occurs more frequently than bison. Pottery was found in the upper part of the same stratigraphic level (Wood 1967). Seven-mile Point site (48-LA-304) displays numerous Late Archaic manifestations, and there are surface indications of occupation in Rocky Mountain National Park (Wood 1967).

Frison (1978) mentions that a variety of unnamed corner-notched points commonly are found in rockshelters and open camps in the Big Horn Mountains and adjacent basins during the Late Plains Archaic. Whether Late Plains Archaic sites from the ROI are comparable to these unnamed complexes is not clear. Alternatively, projectile points from sites within the ROI may be similar to types recovered from three excavated sites near Denver, Colorado, that Leach (1966) and Irwin-Williams and Irwin (1966) suggest show affinities to those from the eastern Plains and the Southwest. Further work is required to resolve these issues.

2.6.2.1.3 Late Prehistoric Period (ca. 1500-200 BP)

The Late Prehistoric period in the study area is characterized by large-scale migrations of groups onto the Plains from various directions. These groups included Athabaskans from the boreal forests of Canada, semisedentary agricultural groups from the eastern prairies, and others from the Great Basin and Plateau areas. The movements and distributions of these groups are traced through a distinct artifact assemblage found throughout the Plains.

This assemblage is characterized by two major technological innovations: the bow and arrow and ceramics. Both appeared on the Plains sometime between 1750 and 1450 BP. Typologically, the shift to arrow points is recognized by a change in projectile point size and shape: Late Prehistoric points usually are small, triangular, and side-notched, although corner-notched points reminiscent of the Late Plains Archaic period also occur. The controversy continues as to whether the bow and arrow is an *in situ* development or the result of inmigration and diffusion.

Other technological innovations that first appear during the Late Prehistoric period include the grooved maul, serrated bison metatarsal bone fleshers, arrow shaft smoothers, straight and expanded base drills, and *Olivella* and *Dentalium* shells (Wedel 1961; Frison 1978). In addition, differing patterns of lithic source usage are noted during the Late Prehistoric period.

The earliest of the small side-notched points to appear on the Northwestern Plains is the Avonlea point. Kehoe and McCorquodale (1961) and Kehoe (1966, 1973) suggest that this small, broad, triangular point with low side-notches and concave base is sufficiently unique and temporally limited to serve as a horizon marker for the early Late Prehistoric period on the Northwestern Plains. The Avonlea point is named from the type-site, a bison drive in southern Saskatchewan, and a date of 1490 BP is given as the best age estimate for its occurrence (Kehoe and McCorquodale 1961).

According to Kehoe (1966, 1973), early Avonlea sites provide the first evidence of large-scale communal bison hunts using bow and arrow. Kehoe also notes that initial Avonlea dates are contemporaneous with terminal Besant dates on the Northern Plains (ca. 1850 to 1500 BP). It is generally accepted that the introduction of Avonlea points represents inmigration of people from

the north (Johnson 1977). Reeves (1969), however, suggests that Avonlea represents an indigenous development from the Pelican Lake complex. Northern origins are suggested by a range of dates that appear to be as much as 200 years older in the northern area of distribution (i.e., north of the Missouri River) (Johnson 1977).

Greiser et al. (1982) note that on the periphery of the Northwestern Plains in areas such as the Big Horn Mountains these points no longer retain the appearance of classic Avonlea; rather, they range from corner-notched to side-notched forms that, at best, can be called "Avonlea-like." In Wyoming, the earliest evidence of Avonlea-like points comes from the Wardell site near Big Piney along the Green River (Frison 1973). Radiocarbon dates at the Wardell site range from about 1600 to 1000 BP. Excavations at an open campsite near Denver have recovered materials characteristic of the Avonlea assemblage that are securely dated between 1200 to 1100 BP (Grant 1980).

2.6.2.1.3.1 Early Ceramic Period/Woodland (ca. 1500-975 BP)

During the Late Prehistoric period, the archaeological record in the ROI is more closely related to events centered in the Central Plains than it is to the Northwestern Plains. Consequently, the following discussion is arranged according to Wood's (1967) division of the Late Prehistoric period into Early, Middle, and Late Ceramic periods. The western portion of the ROI contains few documented ceramic sites; thus, the possibility that this area may have received greater influences from the Northwestern Plains and Great Basin should be considered.

The Early Ceramic period generally is considered to be analogous to the Plains Woodland tradition, named for similarities with Middle Woodland components east of the Missouri River. The most diagnostic artifact of this period is pottery. Although there are spatial and temporal variations in ceramic traits during this time, the most characteristic ceramics are large wide-mouthed vessels with conical bottoms, straight rims, cord-roughened exteriors, and sand or grit temper. Following the Midwestern Taxonomic System (McKern 1939), as modified by Lehmer and Caldwell (1966), scholars generally recognize five variants or "phases" within the ROI. These phases include: the Valley phase of central Nebraska and Kansas (Hill and Kivett 1940); the Keith phase of western Nebraska, western Kansas, and eastern Colorado (Kivett 1949, 1952; Wedel 1959, 1961; Wood 1967), the Ash Hollow phase of southwest Nebraska and northeast Colorado (Champe 1946; Irwin and Irwin 1957; Wood 1967); the Parker phase of northeast Colorado, the Denver Basin, and adjacent foothills (Withers 1954; Wood 1967); and the Hogback phase of the Colorado Front Range (Wood 1967). The following discussion summarizes available information about the temporal and spatial distribution of these various cultural units. Figure 2.6.2-6 indicates known Early Ceramic period sites in the ROI. This is followed by a brief overview of Early Ceramic period technology, subsistence, settlement, and social organization.

Valley Phase. The earliest ceramic phase, the Valley phase, was first defined by Hill and Kivett (1940) from excavations in central Nebraska and surface collections in the Loup River drainage and westward to the sandhills district. The exact time range of the Valley phase is not known, but available evidence suggests a time span of ca. 1850 to 1150 BP. The material culture and subsistence base evident during this phase does not differ markedly from the preceding Late Plains Archaic period. Ceramics are

relatively abundant with the most outstanding traits being decorations near the lip consisting of exterior or interior bosses, a horizontal line of spiral cord-impressions, or incised or trailed lines. Chipped stone artifacts and worked bone also are common. Projectile points are relatively large and have wide lateral to diagonal notches placed near the base. One artifact class that is notably lacking or infrequent is groundstone (Wood 1967).

Specific sites attributable to the Valley phase have not been recorded in the ROI; however, Wood (1967) and Reher (1971) indicate that ceramics of this phase have been collected in the area.

Keith Phase. The Keith phase has been defined from numerous sites in western Nebraska (Kivett 1949, 1952), western Kansas (Wedel 1959, 1961), and eastern Colorado (Wood 1967). Kivett (1952, 1953) and Wood (1967) define the phase primarily on the basis of ceramic traits. The predominant ware, known as Harlan cord-roughened, is described by Wood (1967:597) in the following manner:

> Vessels are large wide-mouthed jars with direct or slightly flaring, unthickened rims and pointed to slightly flattened bases. Exterior cord impressions are applied vertically in parallel rows. Fine cord or fabric impressions are sometimes visible on the interior of the sherds.

Radiocarbon dates from sites in Nebraska and Kansas suggest a temporal span from ca. 1650 to 1150 BP. Although Kivett (1953) suggests that the Keith phase precedes the Valley phase, Wedel (1959) and Wood (1967) consider the Keith phase to be contemporary with Kansas City Hopewell. If so, the Valley phase would precede the Keith phase by almost 200 years.

Wood (1967) and Reher (1971) describe Keith phase ceramics from surface scatters in northeast Colorado and southeast Wyoming, but neither assigns particular sites to this phase.

Ash Hollow Phase. A third type of Woodland ceramic found in the study area is Ash Hollow cord-roughened. This type was described first by Champe (1946) from materials recovered at Ash Hollow Cave in southwest Nebraska. Based on tree ring dates, Champe tentatively suggests a date of 950 to 800 BP for Woodland occupation at the site. Similar ceramics were discovered by Kivett (1952) in the Nebraska Sandhills at the Kelso site, which produced a date of 1150 BP. Although Kivett (1952) concluded, like Champe, that Ash Hollow cord-roughened should be considered a distinct ceramic type, he did note similarities between it and Valley cord-roughened and suggested that the former was related to, or possibly derived from, the latter.

The Ash Hollow phase was formally proposed by Irwin and Irwin (1957). These authors concluded that ceramic types recovered from the Agate Bluff site in northeast Colorado were sufficiently similar to Woodland manifestations at Ash Hollow Cave and the Kelso site to warrant a phase designation. The areal extent of the Ash Hollow phase includes extreme western Nebraska, eastern Colorado north of the South Platte River, and perhaps southeast Wyoming (Wood 1967). Wood supports the Ash Hollow designation and includes Component B at the Hatch site (5-WL-101), which is situated within the ROI. He suggests that this phase may date between 1350 and 950 BP. Steege (1967) maintains that ceramics from Happy Hollow Rockshelter (5-WL-101) in northeast Colorado share attributes with those from Ash Hollow Cave and Agate Bluff.

Key to Figure 2.6.2-6

Selected Early Ceramic Period Sites

Avonlea

1. Wardell

Unassigned Early Woodland Sites

2. Seven Mile Point
3. Owl Canyon Rockshelter
4. Greyrocks
5. Happy Hollow Rockshelter
6. 5-LR-526
7. Gordon Creek Burial
8. 5-WL-210
9. 5-WL-373
10. 5-WL-371
11. 5-WL-48
12. 48-GO-48
13. 48-GO-303
14. 48-GO-307
15. 48-LA-311
16. 48-LA-319
17. Lummis Ranch
18. 48-LA-459
19. Bauer Burial
20. Bosler 1
21. Bull Canyon (not mapped)

Hog Phase

22. Lightening Hill
23. Coal Creek
24. Spring Gulch

Ash Hollow Phase

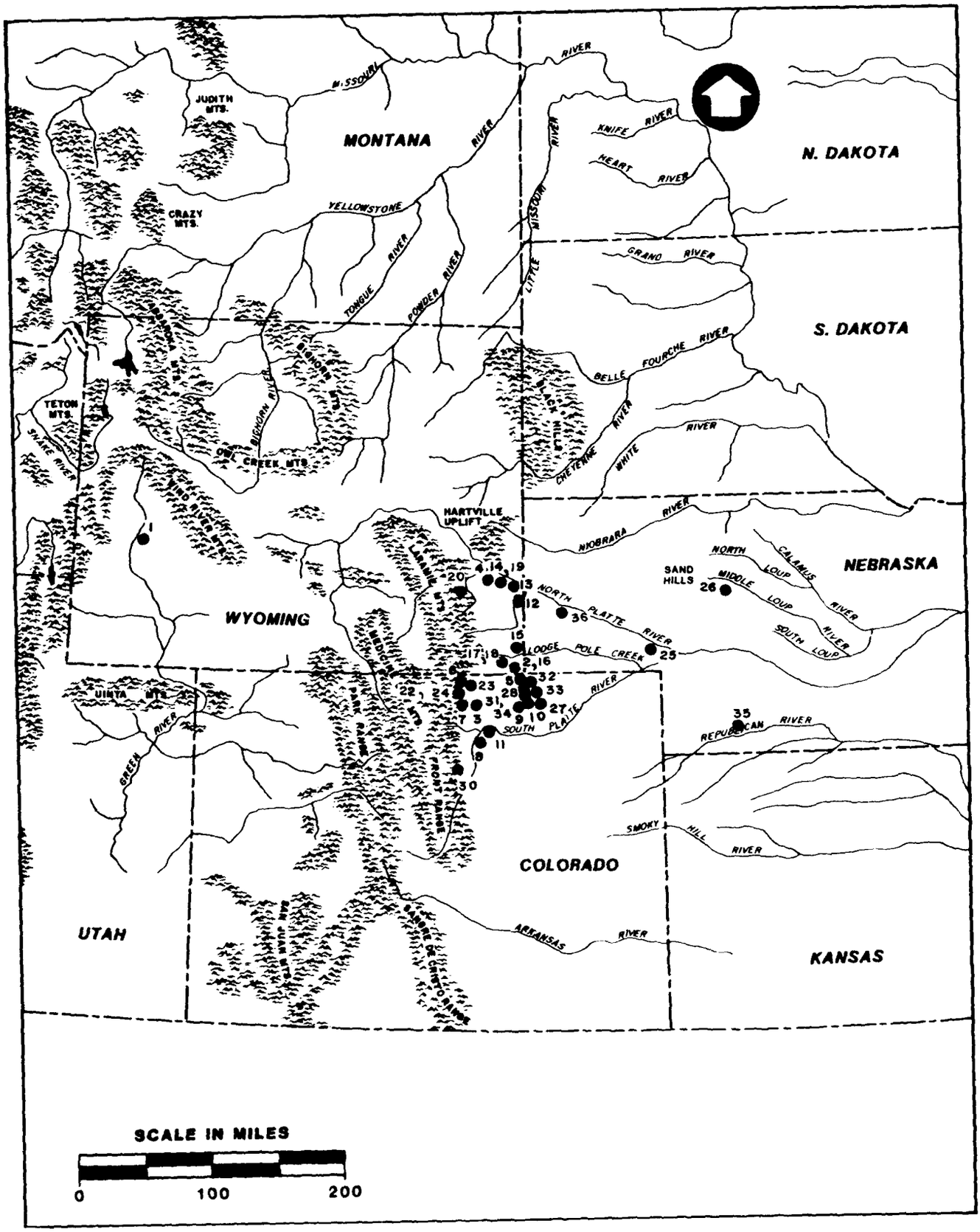
25. Ash Hollow Cave
26. Kelso
27. Hatch
28. Agate Bluff

Parker Phase

29. Willowbrook (not mapped)
30. LoDaisKa
31. Uhl
32. Hackberry Canyon
33. McEndaffer Rockshelter
34. Biggs

Keith Phase

35. Massacre Canyon
36. Bisterfeldt



SELECTED EARLY CERAMIC PERIOD SITES

FIGURE NO. 2.6.2-6

Parker Phase. Another unit within the Early Ceramic period is the Parker phase. This phase was first defined by Withers (1954), who noted that "the greatest concentration of Parker focus materials is in the Denver Basin and along the South Platte River and its tributaries" (Withers 1954:1). He also indicated Parker phase materials could be found farther to the south and west. Nevertheless, Wood (1967) restricts its geographic distribution to northeast Colorado and the Denver Basin. Radiocarbon dates for these sites range from 1290 BP at the Willowbrook site (Leach 1966) to 970 BP at the LoDaisKa site (Irwin and Irwin 1959). Wood (1967) assigns the following sites from the study area in northeast Colorado to the Parker phase: Uhl site, Zone D (5-WL-32); Hackberry Canyon site (5-WL-33); McEndaffer Rockshelter, Complex A (5-WL-31); and Biggs site, Stratum VI Locality II and Stratum II Locality I (5-WL-27). Radiocarbon dates from these sites suggest a 500-year time span from ca. 1850 to 1350 BP. Thus far, no specific sites attributable to the Parker phase have been recorded in Wyoming or southwest Nebraska. Nevertheless, Reher (1971) notes that Parker phase ceramics have been recovered from surface sites in eastern Laramie County.

Hogback Phase. The most distinctive Early Ceramic occupation in eastern Colorado is the Hogback phase. This phase appears to be confined geographically to the extreme western margin of the Plains, with more abundant occurrences in Montana and alpine regions of the Front Range. In many respects, the Hogback phase is similar to the Parker phase of the Denver Basin/foothill area (Wood 1967), and there appear to be affiliations between the Hogback phase and the Keith and Ash Hollow phases in Nebraska (Morris et al. 1979).

Based on excavations in the Front Range, west of Denver, the Hogback phase dates from 1350 to 950 BP and exhibits the following traits: seasonally occupied hunting camps, including small rockshelters and open sites on prominences; small corner-notched points, often serrated; cord-marked pottery; and nonindigenous, naturally polished stones (Nelson 1971).

Current records research revealed only three sites within the ROI assigned to this phase; all are situated just to the north of Fort Collins. At the Lightning Hill site (5-LR-284), Hogback materials were found associated with a stone circle (Morris et al. 1979). The Coal Creek site (5-LR-526) also yielded Hogback phase materials (Hunt 1979), as did the Spring Gulch site (5-LR-252) (Kainer 1974).

Discussion. A number of sites in the ROI are assigned to the Early Ceramic/Plains Woodland period, but not to a particular phase within the period. Discussing Woodland site frequency and distribution in southeast Wyoming, Reher (1971:117) states:

> All of the Woodland material from this area demonstrates the regional variability of the Early Ceramic period material more than it does any close affiliations to any specific focus.

The Owl Canyon Rockshelter (5-LR-104) is a small multicomponent shelter in the ROI that reveals use of the foothills region by Plains Woodland people (Burgess 1975) and provides evidence of small mammal, especially rabbit, and pinyon exploitation during this period (Morris et al. 1979). Seven Mile Point is an important Woodland site located in eastern Wyoming, where Woodland ceramics were recovered in a stratified context; radiocarbon dates are not yet

available. At the Greyrocks site (45-PL-65) near Wheatland, Wyoming, a nearly complete Woodland vessel was recovered and dated to ca. 1750 BP (Frison 1978). Figure 2.6.2-6 shows the widespread distribution of additional sites from this period within the ROI.

Subsistence Strategies. Subsistence data obtained from sites of the Early Ceramic period indicate that hunting and gathering strategies continued to dominate. The subsistence base for the Valley phase appears to have been bison, although deer and small game also are represented in faunal assemblages. Conspicuously absent or infrequently represented from Valley phase sites are groundstone tools, suggesting wild plant foods contributed little to the diet. Mussel shells also are common from Valley phase sites.

Faunal remains from sites of the Keith, Ash Hollow, and Parker phases suggest a marked dependence on hunting with strategies adapted to local environmental conditions. In western Nebraska for example, bison and pronghorn appear to be the most abundant species. Sites from northeast Colorado indicate that deer, pronghorn, and small mammals were preferred game. At sites along the foothills of the Colorado Front Range, deer remains are predominant, but elk, bison, and small mammals also are common. In addition, freshwater mussel shells and migratory waterfowl are found at many sites of the Early Ceramic period, particularly on the Central Plains.

Although no domesticates have been discovered from sites of the Keith or Ash Hollow phases, popcorn and dent corn have been recovered from several Parker phase sites in the Denver Basin. Radiocarbon dates from these sites cluster around the latter half of the Early Ceramic period (ca. 1350 to 950 BP). The presence of maize during the latter half of the Parker phase may be related to improved climatic conditions (Wood 1967). The paucity of cultigens from sites of the Early Ceramic period has prompted Wood (1967) and others to hypothesize that domesticates from Parker phase sites are the result of trade rather than indigenous cultivation. The final word on this argument awaits further testing.

Settlement Patterns. Available information indicates settlement patterns during the Early Ceramic period are generally similar to those established during the preceding Late Plains Archaic period. Archaeological sites occur in diverse environments, from the foothills to the open plains and from rockshelters to open camps. Scott (1973) investigated spatial dispersions among 42 Woodland sites in northeast Colorado. His results suggest that open camps occur most often on high ridges and on low terraces along major streams and their principal tributaries. Wedel (1956) notes that Woodland sites in Nebraska have a wide distribution along smaller rivers and creeks. Rockshelter sites also are common. Scott (1973) observed that nearly 75 percent of these sites have southern exposures, a fact that he attributes to the desire for increased access to sunlight during winter months.

The evidence suggests that groups continued to practice a lifestyle of seasonal migration primarily dictated by resource scheduling, although adaptive changes are suggested by the exploitation of heretofore little used resources (e.g., mussels and waterfowl) and new hunting techniques afforded by the use of the bow and arrow. The increased number of known sites during this period may be interpreted as being the result of population increase. Alternatively, it may be explained by such factors as a shorter period of time for geological processes to obscure sites, improved climatic and geological conditions that facilitated site preservation, or increased site visibility as

a result of longer periods of site occupation. Additional work is needed to adequately resolve these questions.

Social Organization. Little is known about social organization during the Early Ceramic period. Based on continuity in subsistence-settlement systems between the Late Plains Archaic period and the Early Ceramic periods, it is possible to infer that these people lived in small mobile bands whose group size and membership fluctuated seasonally.

During the Keith phase, and perhaps the Ash Hollow phase as well, a new burial practice was introduced into the Central Plains: the ossuary. The Woodruff ossuary (1340 BP) in north-central Kansas is the most thoroughly reported representative of this kind of site (Kivett 1953). The sudden appearance of ossuaries during the Keith phase has prompted Kivett (1953) and Breternitz and Wood (1965) to suggest that this burial practice was the result of intravillage cooperation and integration on a scale previously unknown on the Central Plains.

A single ossuary site has been reported within the ROI. The Bisterfeldt site (25-SF-3), located near Scottsbluff, contains both flexed primary interments in pits and a large ossuary; stratigraphic relationships indicate that the ossuary is the more recent of the two components. Breternitz and Wood (1965) note the similarity in lithic artifacts between the Bisterfeldt and Woodruff ossuaries, suggesting the former may date to the Keith phase. The Massacre Canyon site, situated on the Republican River in Nebraska, also contained primary burials in pits and secondary interments in ossuaries (Kivett 1952). Several individuals at both the Bisterfeldt site and the Massacre Canyon site were partially cremated.

Burials are scarce at Ash Hollow and Parker phase sites. Available evidence indicates that primary flexed interments in individual pits with some grave goods was the preferred mortuary pattern during the Parker phase. Secondary bundle burials, common on the Northwestern Plains, have yet to be reported from Early Ceramic period sites on the Central Plains.

2.6.2.1.3.2 Middle Ceramic Period (ca. 975-450 BP)

Upper Republican. During the Middle Ceramic period, increasingly diverse influences began to filter into the area. One manifestation present within the study area is the Upper Republican phase (Strong 1933). East of Medicine Creek, Nebraska, the Upper Republican Phase is characterized by large sedentary communities, permanent semisubterranean earth lodges, several technological innovations, a distinctive pottery style, and a subsistence base partially dependent upon the cultivation of maize, beans, squash, and sunflowers (Wedel 1934, 1935; Champe 1946; Kivett 1949). Within the ROI, however, archaeological data for this phase are indicative of recurrent, temporary, and perhaps seasonal occupation by small hunting groups (Wood 1967). A number of archaeologists (e.g., Wedel 1956, 1970; Wood 1967) feel that Upper Republican sites found within the study area may represent hunting stations intermittently occupied by people from the east or may represent a cultural manifestation of people transitional between eastern semisedentary horticultural groups and western hunter-gatherers.

One class of artifacts characteristic of the Upper Republican phase within the ROI is ceramics. Upper Republican vessels typically are globular in shape

with rounded bases, constricted necks, and collared rims. Exteriors are cord-marked and often smoothed. The rims generally are decorated with incised lines in geometric shapes, and temper is usually sand or grit. In addition to ceramics, diagnostic artifacts include projectile points that are typically small, triangular, and side-notched with straight bases and blade edges; occasionally, these points exhibit a basal notch. Also common are small, triangular, unnotched points that may have served as projectile point preforms. Although Upper Republican points are distinctive from earlier Woodland types, they are virtually indistinguishable from later period styles and bear close resemblance to Mississippian forms found farther south and east.

Other chipped stone artifacts include knives, various end and sidescrapers, and drills with expanded bases. Groundstone tools change little from the preceding Woodland phase, except that they occur with less frequency. Grooved shaft smoothers and abraders increase in frequency during this time, which probably reflects increased reliance on the bow and arrow. The bone tool assemblage remains virtually unchanged and includes metapodial fleshers, awls, needles, picks, beads, and pendants. Shell disk beads also are found, although they occur in smaller numbers than during the Early Ceramic period.

Within the ROI, Upper Republican sites are widespread. Five sites or components from this phase are reported for southwest Nebraska. In Scotts Bluff County, these include Signal Butte (25-SF-1) and 25-SF-11, and in Banner County, Sheep Mountain (25-BN-1), Bull Canyon (25-BN-2), and Sixty-Six Mountain (25-BN-3). In Wyoming, the majority of Upper Republican sites occur in the southeast corner of the state. Within the ROI, 11 sites are reported within Laramie County, 4 within Goshen County, and 1 in Albany County.

Evidence of Upper Republican occupation in the Colorado portion of the ROI includes Happy Hollow Rockshelter, where Upper Republican ceramics were found in association with a hearth dated at 750 BP (Steege 1967). In the same region, other sites include the Uhl site (5-WL-32), McEndaffer Rockshelter (5-WL-31), Biggs site (5-WL-27), where radiocarbon dates of ca. 645 and 695 BP are reported (Wood 1967), as well as additional sites in Weld County (Figure 2.6.2-7).

Within the ROI, there is no indication that Upper Republican groups practiced agriculture. Like the distribution of earth lodge structures, agriculture does not appear to have been practiced farther west than the Medicine Creek drainage in southwest Nebraska. The subsistence base of Upper Republican groups west of the Medicine Creek drainage shows little deviation from hunting and gathering practices employed by earlier Archaic and Woodland cultures. Thus, one can assume that bison, deer, antelope, rabbit, small game, freshwater mussels, and a variety of wild plant resources were exploited on a seasonal basis. Wood (1967) notes that in southeast Colorado evidence indicates hunting was the major endeavor, with bison comprising the majority of faunal remains in archaeological deposits; evidence of plant processing is scarce.

While the Upper Republican settlement system is poorly understood, a number of patterns have been suggested on the basis of existing archaeological data. Wood (1967) has observed that occupation levels are shallow when compared to earlier units and that rockshelters appear to have been preferred over open campsites. This pattern is noted in the study area, where five of the eight known Upper Republican sites in Weld County are rockshelters. In Wyoming,

Key to Figure 2.6.2-7

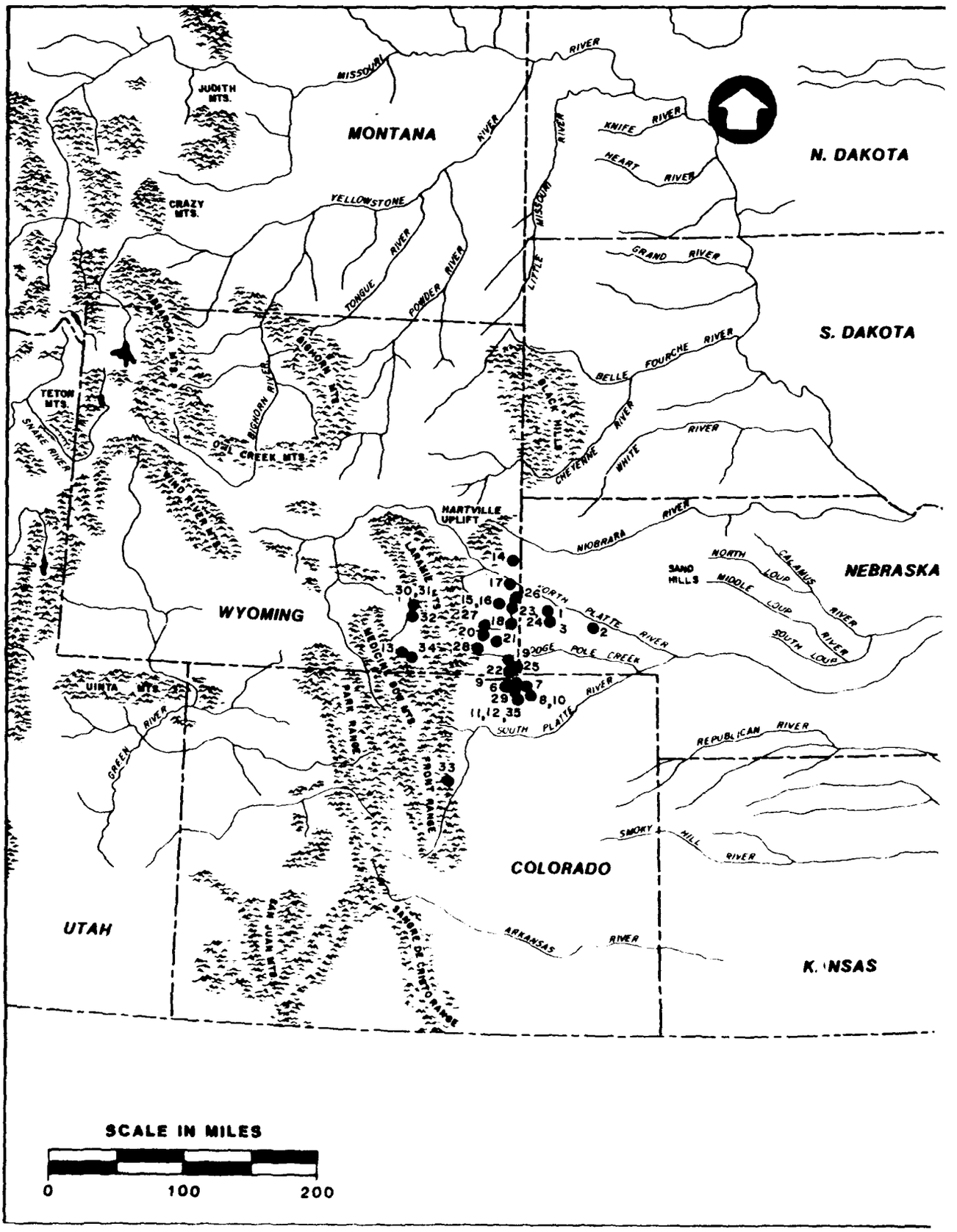
Selected Middle Ceramic Period Sites

Unassigned Middle Ceramic Period Sites

1. Signal Butte
2. 25-SF-11
3. Sheep Mountain
4. Bull Canyon (not mapped)
5. Sixty-six Mountain (not mapped)
6. Happy Hollow Rockshelter
7. Uhl
8. McEndaffer Rockshelter
9. Biggs
10. 5-WL-37
11. 5-WL-39
12. 5-WL-43
13. 48-AB-405
14. Sheep Creek
15. Eagle Rock
16. Castle Rock
17. 48-GO-303
18. 48-LA-237
19. 48-LA-238
20. 48-LA-302
21. Petsch Springs
22. Seven Mile Point
23. Gurney Peak Butte
24. 48-LA-306
25. Pine Bluffs
26. Steamboat Rock
27. Upper JHD
28. 48-LA-320
29. 5-WL-34

Shoshonean Intermountain Pottery Sites

16. Castle Rock
22. Seven Mile Point
27. Upper JHD
30. Shirley Basin
31. Bell Cave
32. Horned Owl Cave
33. LoDaisKa
34. Willow Springs
35. 5-WL-41



SELECTED MIDDLE CERAMIC PERIOD SITES

FIGURE NO. 2.6.2

however, the majority of Upper Republican sites are situated in breaks and uplifted terrain. Reher (1971) notes that several sites dated to this phase in eastern Laramie and Goshen counties occupy high buttes or benches, perhaps reflecting a concern for defense. Most of the recorded sites in southeast Wyoming are open campsites and ceramic scatters.

Other Ceramic Traditions. During the Late Prehistoric period, the western portion of the ROI was occupied by other groups of hunter-gatherers. Certain groups manufactured ceramics, and the distinctive character of their pottery styles and design motifs facilitates identification of particular groups at specific sites. Two major ceramic traditions are found in the study area: Intermountain Tradition pottery and Crow pottery. Intermountain Tradition pottery, regarded as having cultural affiliations with Shoshonean groups (Mulloy 1958; Frison 1978), is the only ceramic tradition that appears to be indigenous to the area. This pottery is distinguished by its flat bottom, flanged base, and general flowerpot shape. Along with fired clay pottery, carved steatite vessels with the same morphological characteristics also are common (Wedel 1954; Frison 1971a).

Evidence for the development of these ceramic traditions appears as early as 1000 to 950 BP in the mountains and foothills of the Western Plains. This is prior to the beginning of the Middle Ceramic period, when the groups responsible for these wares came into contact with Upper Republican peoples (Wood 1967). Both pottery types have been found together in western Nebraska, southeast Wyoming, and northeast Colorado.

Available evidence suggests that a shift to much drier environmental conditions during the period ca. 750 to 650 BP resulted in the withdrawal of Upper Republican groups to the east and north (Nebraska State Historical Society, personal communication, 1983), and perhaps to the south (Baerreis and Bryson 1965). It has been postulated that with the return of favorable climatic conditions (ca. 500 BP), the Intermountain Tradition became the dominant manifestation in the Western Plains (Wood 1967).

Sites yielding Intermountain pottery types occur throughout the Northwestern Plains. As early as 1935, Yelm's studies in Rocky Mountain National Park indicated that this pottery style occurred more frequently in the mountain region, while Upper Republican types are more common in the foothills and plains to the east. More recently, Frison (1978) noted that Intermountain pottery appears to increase in frequency to the north and west in Wyoming. The distribution of this type of ware in the ROI supports these observations, as thus far it is known to occur only in southeast Wyoming, where eight sites are currently recorded. These include 48-AB-30, situated in the Shirley Basin and dated between 450 and 200 BP. Here, the main activity was quarrying and the manufacture of stone tools (Zeimens 1975). At the Red Butte site located south of Laramie, Intermountain pottery was found mixed with cord-impressed types thought to be Upper Republican (Mulloy 1958). Additional sites in the ROI include four in Laramie County, one in Goshen County, and one in Albany County (Figure 2.6.2-7).

Ceramics classified as Crow are more or less restricted to the northeast corner of Wyoming and extend into adjacent states (Over 1936; Mulloy 1942, 1953, 1958; Frison 1967, 1976b). The Crow ceramic tradition is defined on the basis of fewer than 100 vessels recovered from sites in north-central Wyoming and southeast Montana that share certain generalized characteristics (Keyser and Davis 1982). Sometime after 550 BP the Crow moved from the Missouri River

area onto the Plains in what appears to be a series of small-scale migrations (Wood and Downer 1977; Frison 1978; Keyser and Davis 1982). Several ceramic sites are thought to contain evidence of occupation by the Crow beginning ca. 450 BP, when they apparently split from the more sedentary Mandan groups to the east and began to exploit the bison herds of northeast Wyoming (Zeimens and Walker 1977). The movement of the Crow into the area is believed to have been climatologically induced, resulting in increased reliance on bison on the Plains, rather than on agriculture as in the Middle Missouri region. This is particularly true following the introduction of the horse (ca. 250 BP). Others, however, feel that it is debatable whether this Middle Missouri-like pottery is Crow. Reher's recent work has pushed back the date of the occurrence of these ceramics to 750 BP.

Early Crow sites in Wyoming that have been dated include the Big Goose Creek site (530 to 450 BP), the Piney Creek site (370 to 340 BP), and the Medicine Lodge Creek site (230 BP). Most of these are bison kill sites and, along with the Glenrock Buffalo Jump (280 to 260 BP) and the deeply stratified Vore site (450 to 150 BP), they attest to the skill and efficiency that had evolved in bison hunting.

Pueblo pottery has been found along the southern border of Wyoming west of the Platte River; however, these finds have not yet occurred in unequivocable contexts nor have they been associated with other diagnostic materials. Southwestern pottery types have been noted in private collections, reportedly from a site in the Scottsbluff area, but definite onsite evidence has not been found (Nebraska State Historical Society, personal communication, 1983).

One hallmark of the Late Prehistoric period in the region is a style of projectile point known as Plains side-notched, which makes its appearance at approximately 700 BP. Two major competing hypotheses have been advanced to account for its origin: 1) it reached the Northwestern Plains as a consequence of the expansion of Mississippian culture into the region from the east (Kehoe 1973); and 2) its presence is attributable to the migration of Shoshonean speakers from the Great Basin (Madsen and Berry 1975, Wright 1978). Both propositions have much to recommend them, and it is entirely possible that both are valid.

Another important trait of the Late Prehistoric period is a series of distinctive corner-notched point styles that has broad distribution throughout the region among several cultural complexes (Grey 1963, Bass and Lacy 1963, Husted 1969, Frison and Wilson 1975, Frison 1978, McCracken et al. 1978).

2.6.2.1.3.3 Late Ceramic Period (ca. 450-225 BP)

The Late Ceramic period is characterized by the continued expansion of Shoshonean peoples into the study area and the contemporaneous southern expansion of Apache groups, typified by the Dismal River aspect (Wedel 1959; Wood 1967), which lasted until approximately AD 1750 (Wedel 1947).

The Dismal River aspect is recognized by its associated pottery, which has a globular to somewhat elongate shape, constricted neck, and straight to flaring rim. Decoration is confined almost exclusively to the lip and consists of punctates and incised or impressed lines. Projectile points are small, triangular, and unnotched, laterally notched, or laterally and basally notched (Wood 1967).

The Dismal River aspect flourished to the east of the study area, where semipermanent villages were occupied by people who existed primarily by hunting, but who practiced some agriculture from about 300 to 200 BP (Wedel 1959; Gunnerson 1960). Later Dismal River groups may have ventured as far west as Rocky Mountain National Park (Husted 1962).

Within the ROI, no evidence occurs for either permanent structures or agriculture attributable to such groups. Nevertheless, pottery and projectile points characteristic of this aspect are reported. Within the ROI, Dismal River sites are well represented in Nebraska, where five sites are reported in Scotts Bluff and Banner counties (Figure 2.6.2-8). In Wyoming, Dismal River sites are somewhat less frequent. At present, this manifestation has been noted at only five sites in Platte, Laramie, and Goshen counties. In Colorado, although the aspect is widely documented along the South Platte River valley to the east of the ROI (Morris et al. 1979), only two sites are known to occur within the study area. In the Spring Gulch area (5-LR-288), projectile points and pottery characteristic of this aspect have been found (Morris et al. 1979), and at the McEndaffer Rockshelter (5-WL-31), plain, grainy, striated pottery was noted that is similar to Dismal River specimens from western Nebraska (Wood 1967).

2.6.2.1.3.4 Summary

Several sites in the ROI have been identified as belonging to the Late Prehistoric period on the basis of projectile point styles recovered in artifact assemblages. Unfortunately, the lack of datable remains precludes assigning these sites to any particular cultural group. These sites are shown in Figure 2.6.2-9.

Subsistence Strategies. Floral and faunal remains recovered from archaeological sites of the Late Prehistoric period show little change in subsistence practices from the preceding Late Plains Archaic period. Evidence from the Wardell site (Frison 1973), the Foss-Thomas site (Fry 1971), and the Willow Springs site (Frison 1978; Bupp 1981) indicates that communal bison kills, using the corral technique or a combination of the jump and corral techniques, continued to be used. In the Big Horn Mountains and adjacent foothills, archaeological evidence documents the continuation of a mixed hunting and gathering economy based on seasonal resource exploitation.

Frison (1978) notes that sixteenth century sites in the Big Horn and Powder River basins have produced roasting pits in association with sandstone milling stones and handstones identical to those of the Middle and Late Plains Archaic periods. It is not until the advent of "classic" Late Prehistoric bison jumps (e.g., Glenrock, Vore, Big Goose Creek, Piney Creek) that an appreciable change in subsistence strategies is apparent. Evidence from the Vore site (Reher and Frison 1980) indicates that these large-scale communal bison hunts were tied to ecological factors that controlled the number of available animals. Consequently, communal bison drives were not annual affairs.

Alternative resource procurement strategies had to be employed, and a variety of plants and animals were exploited during the seasonal round in order to augment food supplies.

Settlement Patterns. Late Prehistoric sites on the Northwestern Plains are more widespread and numerous than sites from preceding periods. This has led some archaeologists to suggest that the Northwestern Plains were more

intensively and extensively occupied during the Late Prehistoric period. Using evidence from the Powder River Basin, however, Albanese (1979:53) cautions that:

> Because 90 percent of the sites are of undetermined age, we don't know if the Powder River Basin was evenly occupied through time or if occupation increased with time. Also, it is not possible to determine whether the destruction of surface sites by geological processes has been a progressive process through time over a wide area or whether it varies greatly through time and from one drainage to another.

The climatic and environmental changes experienced by hunting and gathering peoples of the Northwestern Plains during the Late Prehistoric period were not of sufficient magnitude or duration to require important adaptive changes. For the most part, the archaeological record underscores continuity of site types, site locations, and subsistence systems. Not until the arrival of the horse and Euramerican settlers is there evidence to suggest that drastic changes took place in settlement patterns, social organization, or subsistence patterns.

Social Organization. The social organization of hunter-gatherer groups of the Late Prehistoric period on the Northwestern Plains does not appear to have been markedly different from that of the Late Plains Archaic. Perhaps the most significant change is the increased size of communal groups required to implement the kinds of large-scale bison jumps that characterize the period between 500 BP and the advent of the horse (ca. 250 to 200 BP). The magnitude of these Late Prehistoric bison jumps argues for increased social complexity and interaction among various local bands.

2.6.2.2 Summary of Known Resources

2.6.2.2.1 Previous Research

The first systematic archaeological investigations in the study area began in the 1930s under the auspices of various universities. In 1930 and 1931, an archaeological survey in eastern Colorado was sponsored by the University of Denver and directed by E.B. Renaud. Included was the area around Fort Lupton in southern Weld County where 34 sites were recorded and important contributions were made to the knowledge of the prehistory of the South Platte River valley between Denver and Greeley. Also included was a large portion of the area drained by the South Platte River between Greeley and Julesburg. These investigations were aimed at establishing comparisons with Wyoming and western Nebraska. Renaud (1932) noted that the Fort Collins area was particularly rich in archaeological remains.

Also important to the study area was the 1931 Denver-Wyoming Expedition, sponsored jointly by the University of Wyoming and the University of Denver. A survey of eastern Wyoming located numerous sites in Albany, Goshen, and Laramie counties (Renaud 1931). As part of the University of Denver's work in 1936, portions of Albany County were traversed and 14 additional sites were identified (Renaud 1938). In 1934, Renaud surveyed for a few weeks in western Nebraska and recorded 65 sites (Renand 1934).

Key to Figure 2.6.2-8

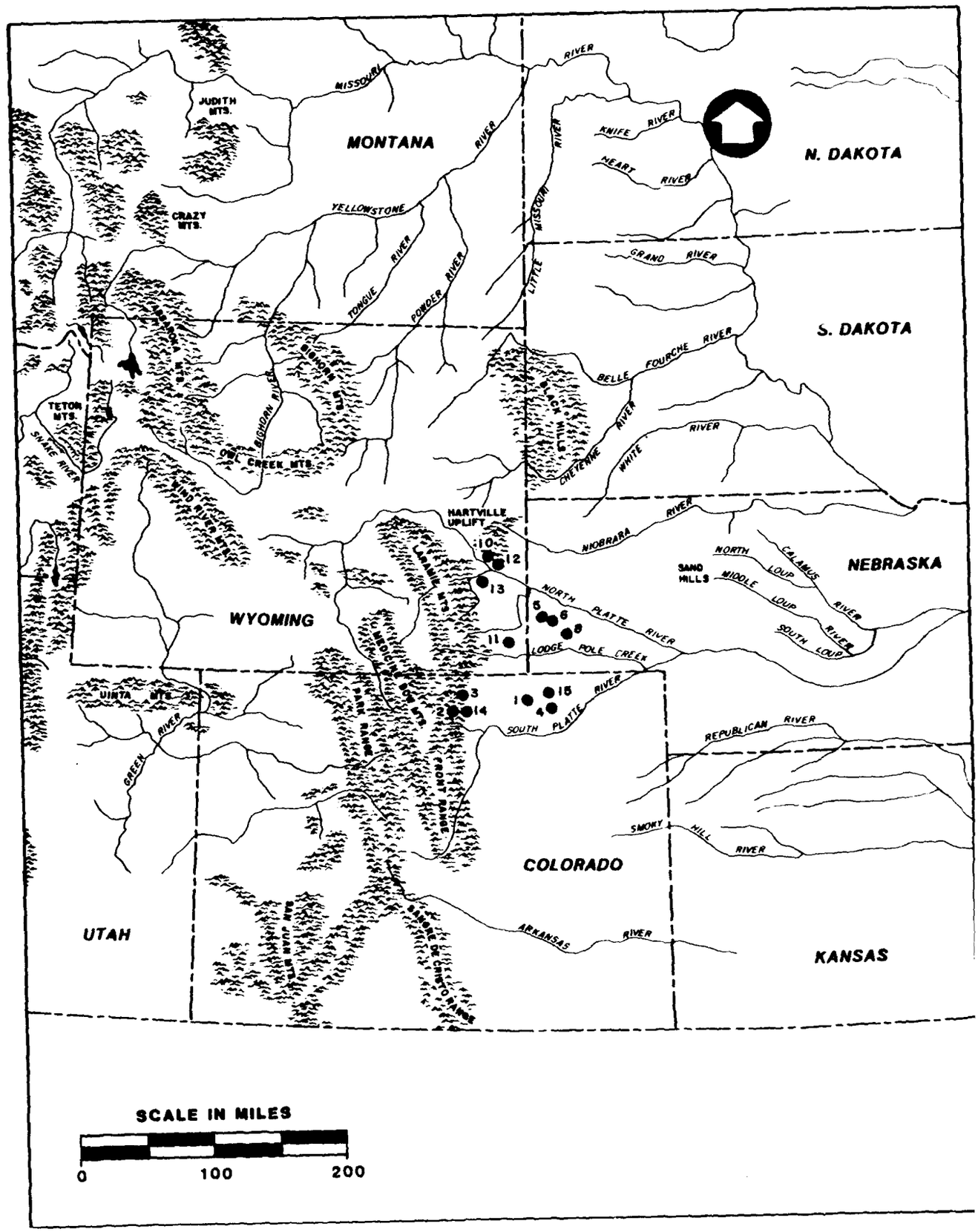
Selected Late Ceramic Period Sites

Unassigned Late Ceramic Sites

1. 5-WL-41
2. 5-LR-258
3. Roberts Buffalo Jump
4. Keota Stone Circles

Dismal River

5. Signal Butte
6. 25-SF-18
7. Bull Canyon (not mapped)
8. Faden Shelter II
9. Nellie Day (not mapped)
10. 48-PL-11
11. Petsch Springs
12. 48-PL-318
13. 48-PL-314
14. Spring Gulch
15. McEndaffer Rockshelter



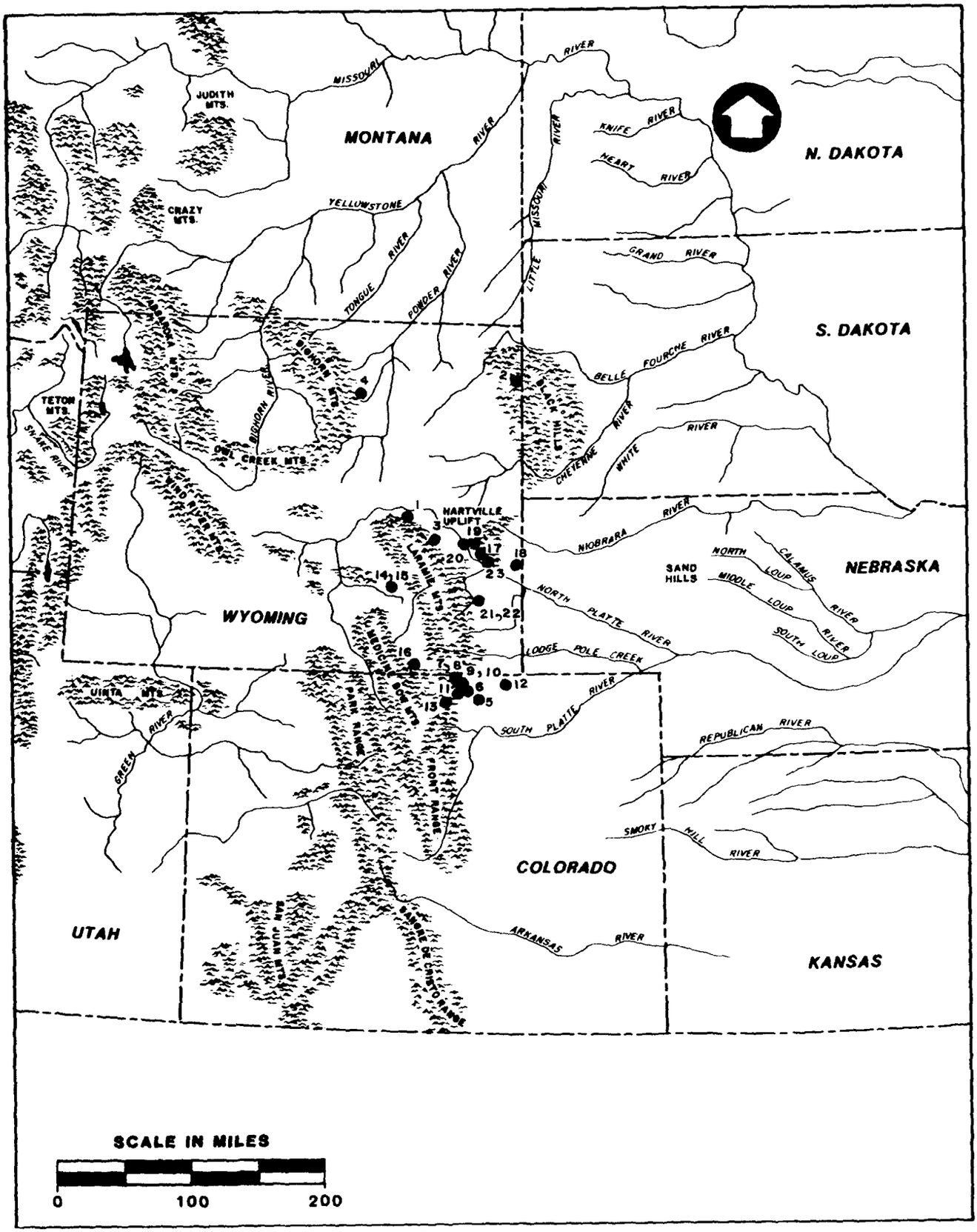
SELECTED LATE CERAMIC PERIOD SITES

FIGURE NO. 2.6.2-8

Key to Figure 2.6.2-9

Selected Late Prehistoric Sites

1. Glenrock Buffalo Jump
2. Vore Buffalo Jump
3. Big Goose Creek Buffalo Jump
4. Piney Creek Buffalo Jump
5. T-W Diamond
6. 5-LR-256
7. 5-LR-110
8. 5-LR-107
9. 5-LR-105
10. 5-LR-257
11. Roberts Buffalo Jump
12. Wilbur-Thomas
13. Hutcheson Burial Site
14. 48-AB-30
15. 48-AB-31
16. Willow Springs Bison Pound
17. 48-GO-2
18. 48-GO-180
19. 48-PL-11
20. North Platte Site (48-PL-29)
21. Graves Ranch
22. 48-PL-97
23. 48-PL-318



SELECTED LATE PREHISTORIC SITES

FIGURE NO. 2.6.2-9

During the 1930s, a number of well-known archaeological sites were investigated with the aim of establishing a regional cultural history. In 1933, Figgins reported the discovery of mammoth remains associated with Clovis points near Dent, Colorado. During 1935 and 1936, the Lindenmeier site near Fort Collins was excavated by the Smithsonian Institution under the direction of H.H. Roberts (Haug 1968). Three years earlier, W.D. Strong, also of the Smithsonian, discovered three distinct cultural horizons at Signal Butte, Nebraska (Strong 1935).

The Nebraska State Historical Society's program to "locate, record, and excavate aboriginal habitation sites throughout the state" began in the early 1900s and gained momentum in the 1930s. Results of research were published in Nebraska History, the society's quarterly journal. The University of Nebraska State Museum also was active in western Nebraska, conducting excavations at Scottsbluff Bison Quarry throughout the late 1930s and early 1940s (Schultz 1943). In 1935, the Colorado Archaeological Society was founded, and its quarterly publication, Southwestern Lore, has continued to be a valuable outlet for Plains research.

On the whole, archaeological work in the 1940s decreased until the post-war years, when the federal government instituted a program of reservoir construction. This program resulted in the formation of the Smithsonian Institution's River Basin Survey Program, aimed at recovery of archaeological data prior to dam construction; efforts were limited by time, and reporting requirements were minimal. Glendo Reservoir in Platte County, Wyoming, was the focus of study in the late 1940s (Bliss and Hughes 1947; Bliss 1948) and resulted in the recordation of approximately 40 sites.

Concurrently, the fifth Plains Anthropological Conference was held at Lincoln, Nebraska, and the university soon became the center for Plains anthropology and was tied to the River Basin Survey (Haug 1968). The University of Wyoming also began its archaeological program in the late 1940s, publishing its research results in the University of Wyoming Publications series.

Survey work continued in the Glendo Dam area into the following decade. During the summer of 1957, the National Park Service and the University of Wyoming investigated 2 of the 45 known sites in the area. One site revealed "the first clear evidence of lodge sites associated with the Late Middle Prehistoric Period in Wyoming" (Mulloy 1965:23). Work continued the following summer, with additional sponsoring by the Wyoming State Museum. Three sites were investigated that contributed valuable information for the reconstruction of Northwestern Plains prehistory. By the 1958 field season, the reservoir was partly filled (Mulloy and Steege 1967).

In the late 1950s, construction of an extensive network of interstate highways was initiated throughout the country and led to the institution of various state highway archaeological salvage programs to deal with cultural resource concerns. Awareness of increasing destruction of cultural resources resulting from various public and private developments became apparent. For example, in the summer of 1955 and 1956, when the Colorado Interstate Gas Company planned to construct a natural gas pipeline through Wyoming and Colorado, concern over the loss of resources resulted in an attempt by a number of professional and amateur archaeologists to survey an area 360 miles long and 50 feet wide from Green River, Wyoming, to Denver, Colorado (Malouf 1961). Although survey conditions were less than ideal and portions of the pipeline were inventoried by a single archaeologist following in the tracks of a bulldozer, the sites

that were recorded provide valuable information about site frequency and dispersion in various environmental zones.

A number of new publication series began in the 1950s. In 1951, the Nebraska State Historical Society's Publications in Anthropology began to publish results of fieldwork in a series of reports. The journal, Plains Anthropologist, was founded in 1954 and continues to serve as the major source of information for Plains archaeology.

Results of previous archaeological work conducted on the Northwestern Plains was used by Mulloy (1958) to construct a cultural chronology for the region (Figure 2.6.2-1). While more recent research has revealed the shortcomings of Mulloy's scheme, it has still remained a useful tool for the interpretation of archaeological remains.

University-based research continued into the 1960s. During the summers of 1960 and 1961, Rocky Mountain National Park and adjacent areas were surveyed by Husted (1962), and Galloway and Agogino's investigations at the Johnson site, a Folsom site near LaPorte, were published (Galloway and Agogino 1961). The Lamb Springs site, located just southwest of Littleton, was excavated by the Smithsonian Institution under the direction of Waldo Wedel (1963). In 1967, Wood completed his work summarizing archaeological investigations in northeast Colorado (Wood 1967); his study remains a major reference for the prehistory of this area. Reher (1969) recorded 26 archaeological sites in the vicinity of Pine Bluffs, Wyoming.

In Nebraska, under the Highway Archaeological and Historical Salvage Program, surveys were conducted along more than 1,200 miles of rights-of-way in all parts of the state between 1965 to 1968. Work conducted in the Platte River valley and along Lodgepole Creek included some of the earliest surveys in the Nebraska portion of the ROI. Although the 1965 to 1968 studies recorded 50 new sites in 23 different counties, only 1 site (25-KM-1) was found in the ROI (Carlson and Jensen 1973). The program continued from 1969 through 1973 (Carlson and Steinacher 1973).

In the late 1960s and early 1970s, a number of federal statutes and regulations were passed that were aimed at protecting cultural properties potentially threatened by various public and private developments. Archaeology entered a new era, with contract archaeology becoming the principal means for conducting research (King et al. 1977). With the mandate that projects on federal lands or receiving federal funds must include consideration of their effects on the environment, large tracts of land encompassing numerous environmental zones were inventoried for the presence of cultural remains.

In Wyoming, such studies were conducted in conjunction with hydroelectric power projects (Metcalf 1974; Zeimens and Walker 1977) and associated transmission corridors (Todd et al. 1977; Johnson 1979a; Reiss 1979; Zeimens 1979). A survey conducted for the Missouri Power Project Tri-State Transmission facilities included a 100 foot wide, 81 mile long corridor that traversed diverse environmental settings. This study resulted in the recordation of 13 prehistoric and 3 historic sites (Blatchley and Welty 1980). Other archaeological studies were conducted in conjunction with placement of underground power or waterlines (Francis 1979; Eckles 1981; LeVasseur and Linnabery 1981), road improvement projects (Mahan and Eckles 1979; Sanders 1980; Welty 1980), telephone cables (Johnson 1979b; Loscheider 1980; Albanese 1981), and natural gas pipelines (Longenecker 1977;

Archaeological Services 1979). In 1981, an overview and survey was conducted of a 430-mile pipeline that included portions of Nebraska, Colorado, and Wyoming. This study was aimed at defining "interrelationships between past societies and their natural environment" (Commonwealth 1981:8). The ETSI coal slurry line cultural resources inventory followed a 200-foot right-of-way from Van Tassel, Wyoming, to the Colorado border, including portions of Goshen and Laramie counties. A total of 14 sites and 27 isolated artifacts were recorded (Reher 1982; Reher and Harrell 1982). A survey of over 1,000 acres was recently conducted for the Chicago and Northwestern Railroad lines in Goshen County (Fawcett and Welsh 1982), and in 1982, a cultural resource assessment for proposed geotechnical testing was performed by Ertec Northwest, Inc. in the vicinity of F.E. Warren AFB. In the latter study only one prehistoric site was noted (Ertec Northwest 1982). An important contribution to Plains prehistory was the 1978 publication of Frison's Prehistoric Hunters of the High Plains, which summarizes current knowledge of Northwestern Plains prehistory.

Energy-related projects also have been conducted in the Colorado portion of the ROI. During the summer and fall of 1974, an archaeological survey was performed by Colorado State University and the University of Northern Colorado in conjunction with the Narrows Project reservoirs. Over 300 prehistoric and historic archaeological sites were identified, representing 11,000 years of occupation in Weld and Morgan counties (Morris 1974). Other studies in this same region have been related to transmission line construction (Breternitz et al. 1974), natural gas pipelines (McNamara 1978), and oil explorations (Rosenberg 1981).

Between 1972 and 1979, Colorado State University was enlisted by the National Park Service to assess the effects that the proposed Boxelder Creek watershed management program would have on cultural resources in northern Larimer County. This study resulted in an increased understanding of the prehistory of the prairie-mountain ecotone in northeast Colorado (Morris et al. 1979).

The Colorado Highway Salvage Program was first begun in the early 1970s by the Colorado State Historical Society and the Department of Highways (Hester 1974). In late 1974, a cooperative agreement was initiated between the U.S. Forest Service and the Colorado State Historical Society for the protection and management of cultural resources, including those in the Arapaho-Roosevelt National Forest. Other studies occurred in conjunction with Bureau of Land Management land sales (e.g., Darlington 1982; Trapp 1983).

A number of Colorado universities were involved in archaeological excavations within the ROI between 1973 and 1975. In 1973 and 1974, excavations were conducted by Colorado State University at the Spring Gulch site in Larimer County, and numerous additional sites were surveyed (Kainer 1974). The University of Northern Colorado excavated at 5-WL-48, near Kersey, during this time. In the following year, Owl Creek Canyon Rockshelter (5-LR-104) was investigated by the Colorado Archaeological Society and Colorado State University (Burgess 1975).

Nebraska likewise experienced an increase in archaeological studies; however, the extreme western portion of the state was little affected by this development. The Nebraska State Historical Society's program to inventory and excavate sites throughout the state continued, as did the Highway Salvage Program. As a result, a number of additional sites were recorded in Banner, Kimball, and Scotts Bluff counties (Jensen 1973; Holen and Ludwickson 1980),

and additional sites were added to the Nebraska inventory based on reports by local residents. Carlson and Steinacher's (1978) proposed cultural history for the Plains Archaic period is one of the few syntheses of Nebraska prehistory that includes the area encompassed by the ROI.

2.6.2.2.2 The Resource Inventory

Previous archaeological research in the ROI demonstrates that the cultural inventory of the region spans approximately 11,000 years of human occupation, ranging from the Paleo-Indian through the Protohistoric periods. Included in the inventory of sites are several well-known, unique localities that have considerable importance to the archaeology of North America: the Hell Gap site in Wyoming, Signal Butte in Nebraska, and Lindenmeier in Colorado. For example, the Dent site, also located in Colorado, provided the first concrete evidence for establishing the contemporaneity of man and mammoth in the Western Hemisphere.

A review of inventories maintained by the Colorado, Nebraska, and Wyoming State Historic Preservation Offices revealed that approximately 1,500 prehistoric archaeological sites and hundreds of additional isolated artifacts have been recorded within the ROI. Table 2.6.2-1 provides a summary account of the number of recorded sites and their current status in terms of eligibility for inclusion in the National Register of Historic Places (NRHP) for each of the nine counties included in the ROI. Examination of the data contained in this enumeration points up the high degree of variability among the counties. It is likely, however, that observed intercounty differences reflect variability in the extent of prior inventory work in these same areas rather than the actual densities of existing prehistoric sites; this same observation applies to inventory data for the other resource elements as well.

The known resource inventory includes a wide variety of site "types" that may reflect important differences in the kinds of cultural activities that took place during their occupation or use. These include open camps, stone circles and alignments, lithic and ceramic scatters, rockshelters, cairns, burials, quarries, kill sites, and pictographs/petroglyphs. A tabulation of relative frequencies for the various recognized site categories (Table 2.6.2-2) exhibits consistency from county to county, suggesting that the observed frequency distribution may have considerable utility for regional scale characterizations.

Of the nearly 1,500 prehistoric sites currently recorded in the ROI, only five are listed in the NRHP, and an additional 35 have been formally determined to be eligible for listing. Although 56 sites have been officially designated as "not eligible," the overwhelming majority of sites have not been evaluated in terms of NRHP criteria. None of the sites listed in the statewide inventories are located within the ACS.

Resource inventories undertaken in support of facilities siting efforts at F.E. Warren AFB during the summer and fall of 1983 resulted in the identification of 24 previously unrecorded prehistoric sites (Table 2.6.2-3) and 14 isolated artifact finds. Although evaluative efforts have yet to be completed at many of the sites located during inventory, preliminary results based on field observations at all resource loci and analyses of systematic surface collections and/or test excavation data at several sites suggest that many of these resources may be eligible for inclusion in the NRHP (Table 2.6.2-3).

Table 2.6.2-1

RECORDED PREHISTORIC SITES IN THE REGION OF INFLUENCE

	Location	Number of Sites	Status[1] R	E	D	N	Examples of Known Sites
Wyoming	Albany Co.	108	-	6	-	9	
	Goshen Co.	52	-	10	-	11	Spanish Diggings; Hell Gap
	Laramie Co.	113	-	7	-	14	Seven Mile Point
	Platte Co.	142	-	9	-	18	Bowman Effigies
Nebraska	Banner Co.	19	-	-	-	-	
	Kimball Co.	31	-	-	-	-	
	Scotts Bluff Co.	17	1	-	-	-	Gering Burial; Scotts Bluff Bison Quarry; Signal Butte; Bisterfeldt site
Colorado	Larimer Co.	529	1	2	-	-	Lindenmeier; Lykins Valley Site, Spring Gulch; Johnson site
	Weld Co.	423	3	1	4	4	Dent site; Powars site; Keota District; Wilbur-Thomas

Note: 1 R = On Register; E = Eligible; D = In District; N = Not Eligible

Table 2.6.2-2

FREQUENCY OF RECORDED PREHISTORIC SITE TYPES IN THE REGION OF INFLUENCE

	Wyoming								Nebraska						Colorado					
	Albany		Goshen		Laramie		Platte		Banner		Kimball		Scotts Bluff		Larimer		Weld		Totals	
Site Type	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Campsite	13	12	9	19	11	12	40	28	4	29	1	11	1	8	146	33	152	37	377	29
Tipi Ring	9	9	5	10	13	14	4	3	1	7	1	11	0	-	40	9	68	16	141	11
Tipi Complex	10	10	4	8	10	11	20	14	0	-	0	-	0	-	3	1	4	1	51	4
Lithic Scatter	38	36	12	25	23	24	46	33	1	7	0	-	1	8	213	48	129	31	463	36
Ceramic Scatter	0	-	0	-	18	19	1	<1	0	-	0	-	1	8	1	<1	5	1	26	2
Ceramic + Lithics	1	1	1	2	0	-	0	-	1	7	0	-	0	-	8	2	7	2	18	1
Rock Shelter	4	4	0	-	3	3	7	5	3	21	2	22	3	25	16	4	12	3	50	4
FCR	15	14	4	8	8	8	1	<1	0	-	2	22	1	8	0	-	0	-	31	2
Quarry	5	5	5	10	6	6	13	9	1	7	1	11	0	-	3	<1	20	5	54	4
Kill Site	4	4	0	-	1	1	2	1	0	-	0	-	1	8	2	<1	3	<1	13	1
Burial	3	3	7	15	1	1	3	2	0	-	2	22	3	25	7	2	3	<1	29	2
Rock Alignment	1	1	1	2	0	-	0	-	3	21	0	-	0	-	2	<1	10	2	17	1
Cairn	1	1	0	-	1	1	4	3	0	-	0	-	0	-	0	-	1	<1	7	1
Rock Art	1	1	0	-	0	-	0	-	0	-	0	-	1	8	3	<1	1	<1	6	<1
Other	0	-	0	-	0	-	0	-	0	-	0	-	0	-	1	<1	1	<1	2	<1
TOTALS:	105	101	48	99	95	100	141	98	14	99	9	99	12	98	445	98	416	98	1,285	99

Note: 1 The total number of sites for each county differ from those listed in Table 2.6.2-1 because not all sites in county inventories have been classified by type.

Table 2.6.2-3

INVENTORY OF KNOWN PREHISTORIC ARCHAEOLOGICAL SITES AT F.E. WARREN AFB

Site Number[1]	Site Type	Time Period	Potential National Register Eligibility[2]
48-LA-241	Lithic scatter	Undeterm.	Not eligible: site lacks surface or subsurface integrity; redeposited by road construction
48-LA-244	Lithic scatter	Undeterm.	Not eligible: total inventory consists of two nondiagnostic artifacts in a disturbed context
48-LA-245	Lithic scatter	L. Archaic-L. Prehst.	Eligible: contains intact buried deposits and features; extensive data potential
48-LA-247	Lithic scatter	Undeterm.	Undeterm.: additional data required
48-LA-250	Lithic scatter	M. Archaic-L. Prehst.	Not eligible: deposits deflated/eroded; lacks surface and subsurface integrity
48-LA-251	Lithic scatter	Undeterm.	Eligible: appears to have intact subsurface deposits; additional data recovery required
48-LA-253	Subsurface bone and lithic debris scatter	Undeterm.	Eligible: appears to have intact subsurface deposits; additional data required
48-LA-259	Subsurface lithic scatter	L. Prehst.	Eligible: possibly contains intact subsurface deposits; surface assemblage includes two diagnostic artifacts
48-LA-260	Light scatter of prehistoric lithic debitage and historic artifacts	Undeterm.	Eligible: mixed prehistoric and historic deposits; additional data required
48-LA-262	Scatter of prehistoric lithic debitage and historic debris	Undeterm.	Eligible: mixed prehistoric and historic deposits; additional data required
48-LA-263	Light scatter of prehistoric lithic debitage and historic glass fragments	Undeterm.	Eligible: mixed prehistoric and historic deposits; additional data required
48-LA-264	Lithic scatter	Undeterm.	Eligible: partially disturbed; additional data required

Table 2.6.2-3 Continued, page 2 of 2
INVENTORY OF KNOWN SITES

Site Number[1]	Site Type	Time Period	Potential National Register Eligibility[2]
48-LA-265	Moderate lithic scatter; possible campsite	L. Prehst.	Eligible: possibly contains intact subsurface deposits; surface assemblage includes two diagnostic artifacts
48-LA-267	Very light lithic scatter	Undeterm.	Not eligible: site lacks surface or subsurface integrity; disturbed by road construction
48-LA-268	Light lithic scatter	Undeterm.	Undeterm.: possibly contains intact subsurface deposits, additional data required
48-LA-270	Very light lithic scatter	Undeterm.	Not eligible: highly disturbed context
48-LA-271	Light lithic scatter	E. Archaic(?)	Undeterm.: context appears highly disturbed; presence of one diagnostic artifact; additional data required
48-LA-272	Very light lithic scatter	Undeterm.	Eligible: additional data required
48-LA-274	Very light lithic scatter	Undeterm.	Undeterm.: possibly disturbed; additional data required
48-LA-276	Very light lithic scatter	Undeterm.	Not eligible: surface inventory consists of 3 items; site context highly disturbed
48-LA-277	Lithic scatter with extensive subsurface deposit; 2 hearths	Undeterm.	Eligible: partially destroyed, but intact portions contain surface and subsurface deposits
48-LA-279	Diffuse lithic scatter	L. Archaic	Eligible: possibly contains intact subsurface deposits; additional data required
48-LA-281	Light prehistoric lithic scatter and historic debris scatter	Undeterm.	Eligible: mixed prehistoric and historic deposits; additional data required
48-LA-450	Subsurface lithic scatter	Undeterm.	Undeterm.: represented solely by subsurface deposits; additional data required

[1] Site numbers are designated according to the Smithsonian Trinomial Numbering System: 48 = Wyoming; LA = Laramie County; and a series number corresponding to the numeration of sites within the County.

[2] Eligibility determinations are based on preliminary Air Force evaluations. Concurrence from the Wyoming State Historic Preservation Officer will be sought before final determinations are made.

2.6.2.3 Summary of Expected Resources

Although current regional inventory data include more than 1,500 recorded sites within the ROI, this by no means represents a complete accounting of the extant prehistoric resources in the area. Indeed, given that an estimated 2 percent or less of the available surface area within this same region has been the focus of prior archaeological survey, it is apparent that the total number of prehistoric sites potentially existing within the ROI is quite large. Unfortunately, available data are such that it is unfeasible to attempt accurate predictions of the numbers of resources potentially available within the overall area or its constituent parts. Two primary reasons can be cited for this. First, it would be difficult, if not impossible, to establish an accurate estimate of the percentage of the ROI's surface area that has been subject to prior resource survey. In the absence of such information, appropriate density multipliers cannot be developed to calculate the number of resources within a specified area. Second, the current inventory is not the product of reliable, unbiased spatial coverage of the region; instead, the inventory is largely the result of surveys of numerous proposed public and private developments that have been required to include resource inventory and evaluation in fulfillment of federal and state statutory requirements. Because the spatial distribution of these projects is by no means random, it is not possible to generate accurate or reliable estimates of resource dispersion.

Despite the inherent difficulties accompanying any attempt to use the existing data base to generate quantitative estimates of the number, kinds, and locations of prehistoric sites occurring within areas potentially subject to direct or indirect impacts as a consequence of the Proposed Action, the current inventory does provide a basis from which to develop at least qualitative resource expectations. In the paragraphs that follow, such estimates are derived and are used subsequently in the characterizations of anticipated project effects that constitute the focus of discussions in Section 3.0. Particular attention is devoted to specifying biases in the record that may greatly affect the accuracy of such projections.

Expectations for prehistoric cultural resources occurring within the ROI were generated by using the available resource inventory to make qualitative predictions for the area as a whole. While it is recognized from the outset that existing data may be biased, they still should provide a reasonable approximation of the relative proportions of the various site types occurring within the overall resource population. Examining the information contained in Table 2.6.2-2, it is apparent that the majority of sites potentially occurring within the ROI should be either "campsites" or "lithic scatters." These two site types account for 66 percent of the current inventory. The third most abundant class of sites consists of "tipi rings" and "tipi ring complexes," which constitutes 15 percent of the inventory. The remaining resource types that occur in any abundance are either habitation loci (e.g., rockshelters) or special purpose sites (e.g., quarries and burials).

Although the descriptive information contained within Table 2.6.2-2 may provide a reasonably accurate picture of the relative frequencies with which various site types occur in the ROI as a whole, the utility of this summary is fairly limited. In this regard, two obvious questions come to mind:

- To what degree are the relative frequencies of these site types uniform through time?

- To what degree are these frequencies uniform across space?

In so far as temporal variability in the prehistoric site inventory is concerned, current data do not permit a resolution of this question. Although it is likely that significant temporal variation should exist in the archaeological record (Section 2.6.2.1), accurate age estimates are available only for a very few sites. On the other hand, spatial (environmental) data are available for most prehistoric sites, and it is this aspect of the record's variability that is the focus of subsequent analyses.

It has long been recognized that hunter-gatherer societies (e.g., those that occupied the ROI for several millenia) distribute themselves over the landscape in ways that are tied to the spatial dispersions of resources important to the resident cultural system's economic well-being. Given that the area contained within the ROI is environmentally diverse, it is highly likely that the spatial patterning of cultural activities is equally diverse. This working hypothesis has important consequences for making reliable projections of the numbers and kinds of prehistoric sites expected to occur in some given area; such estimates will have to account for associated environmental variability.

In order to identify and characterize regional environmental variability that has potential consequences in the prehistoric cultural record, the ROI's terrain was divided into ten general landform components using a classificatory system similar to that proposed by Crosby (1978) for the Colorado Front Range Urban Corridor. These ten classes (Table 2.6.2-4), which *should* differ significantly from one another in terms of the kinds of resources they may have provided indigenous aboriginal groups, are grouped into two major complexes: 1) a Plains/Piedmont Complex, consisting of the High Plains surface and associated lowlands as well as hogbacks flanking the Laramie and Front ranges; and 2) a Mountain Complex, consisting of the mountainous terrain of the Laramie and Front ranges.

For all sites included in the analysis, characterizations of local environmental conditions were handled in a systematic, straightforward manner. The first step in this process consisted of plotting each site that had accurate locational information onto standard topographic maps: sites in Colorado were plotted at a scale of 1:50,000, while Wyoming and Nebraska sites were rendered at a scale of 1:24,000. Next, the approximate areal extent of each landform component occurring within a radius of 2 kilometers from each site was visually determined and entered onto a coding form according to the following scheme:

- Code 1 = 1-25 percent coverage;

- Code 2 = 26-50 percent coverage;

- Code 3 = 51-75 percent coverage; and

- Code 4 = 76-100 percent coverage.

A 2-kilometer search radius was chosen for this analysis because it was felt that the use of such a convention would more accurately reflect the

Table 2.6.2-4

DEFINITIONS OF LANDFORM COMPONENTS

	Component	Description
PIEDMONT / PLAINS COMPLEX	A. Floodplain, Valley Floor	The surface or strip of relatively smooth land adjacent to a river channel, constructed by the present river in its existing regime. Located at lower elevations than terraces, this component is found along major and tributary drainages in the ROI and includes channels associated with perennial and intermittent streams. Locally may include arroyos.
	B. Terrace	A long, narrow, relatively level, inclined surface, generally less broad than a plain found flanking drainages at elevations above the floodplain. Represents an abandoned floodplain. Within the ROI it is found bordering floodplains and valley floors of major and some tributary drainages. Discontinuous in many areas.
	C. Mesa, Butte, Ridge	A mesa is an isolated, nearly level landmass standing above the surrounding country, bounded by abrupt or steep sloping escarpments on all sides. A butte is a smaller version of a mesa. Ridges are long, narrow landmasses and include hogbacks flanking the Laramie and Front ranges and high (with respect to the topography within 2 km of a site) interfluves.
	D. Undissected Plain	An area of comparatively smooth and level or gently undulating land, having no prominent surface irregularities. Includes gently rolling topography of High Plains surface, as well as other relatively undissected, gently rolling topography.
	E. Dissected Plain	Area in which gullies, channels, and ravines have divided the landscape into a series of hills, interfluves, ridges, and valleys. Includes dissected High Plains surface and terrain associated with Badlands topography.
	H. Hillslope	Part of a hill between the crest and the drainage line at the foot of the hill. This component used only when a significant proportion of area within 2 km radius of site is at slopes greater than or equal to about 5 percent.
MOUNTAIN COMPLEX	I. Alpine Meadow	Flat-bottomed or U-shaped, gently to moderately sloping valley segments. Includes segments of some glacially altered valleys and valleys partially filled with alluvium and colluvium.
	J. Ridge	Interfluves adjacent to canyons in mountainous terrain.
	K. Hillslope	Part of a hill between the crest of the interfluve and the adjacent valley floor. Generally rough and steep surfaces that rise from the valley floor.
	L. Valley Floor	V-shaped, nonglaciated segments of valleys. Generally more steeply sloping and narrower than alpine meadows. Includes valley segments mantled with terrace, glacial drift, or glaciofluvial deposits, but still having a V-shape.

prehistoric occupants' original siting considerations. Hunter-gatherer populations tend to locate themselves over the landscape so as to have ready access to critical economic resources (e.g., water, food) and, in the absence of data to the contrary, a 2-kilometer one-way trip distance is a reasonable point of departure for characterizing the locally accessible environment. In addition, where available, the specific landform component upon which the actual site was located also was noted; however, the uncertainty involved in making this attribution for a majority of the sites was so high that such categorizations likely contain substantial bias. Consequently, further discussion of site-environment relationships is restricted to the 2-kilometer radius data. In all, 950 prehistoric sites were classified according to the procedure described above.

Once information regarding site type and local landform characteristics had been coded onto appropriate forms, the data were keyed into a computer for further processing. The resultant data base was sorted by landform component and site type (Table 2.6.2-5), and a series of histograms was developed to display the frequency distribution of site types within each landform component class (Figure 2.6.2-10). For the purposes of this analysis, the two site types known as "tipi rings" and "tipi ring complexes" (Table 2.6.2-2) were combined into a single class ("tipi rings") because of interstate inconsistencies in the recognition and recording of these two classes. Also, only landform components having more than 30 cases are displayed in Figure 2.6.2-10 in order to avoid drawing conclusions based on percentages that are the product of minute frequency differences.

Inspection of the data presented in Table 2.6.2-5 and Figure 2.6.2-10 leads to a number of observations that may have important consequences for predicting resource occurrences in areas subject to future inventory. Before discussing these results, however, a few further comments are in order regarding the analytic basis upon which Table 2.6.2-5 and Figure 2.6.2-10 are derived. It will be noted that the total number of cases (n = 898) upon which these portrayals are based is less than the total number of sites in the sample population (n = 950). The reason for this apparent discrepancy is that these displays include only instances in which the estimated extent of areal coverage for a given landform component within a 2-kilometer radius of a site is greater than 25 percent. This convention was used because it eliminated the potential influence of cases in which the areal extent of a landform component is so small that it probably had no bearing on site placement. At the same time, this convention minimizes the inherent problems associated with trying to determine from mapped data alone whether a particular landform indeed occurs within 2 kilometers of a site; the smaller the landform, the greater the probability that the landform does not occur at all. Although use of this areal cutoff point introduces its own bias into the analysis, the benefits far exceed the costs.

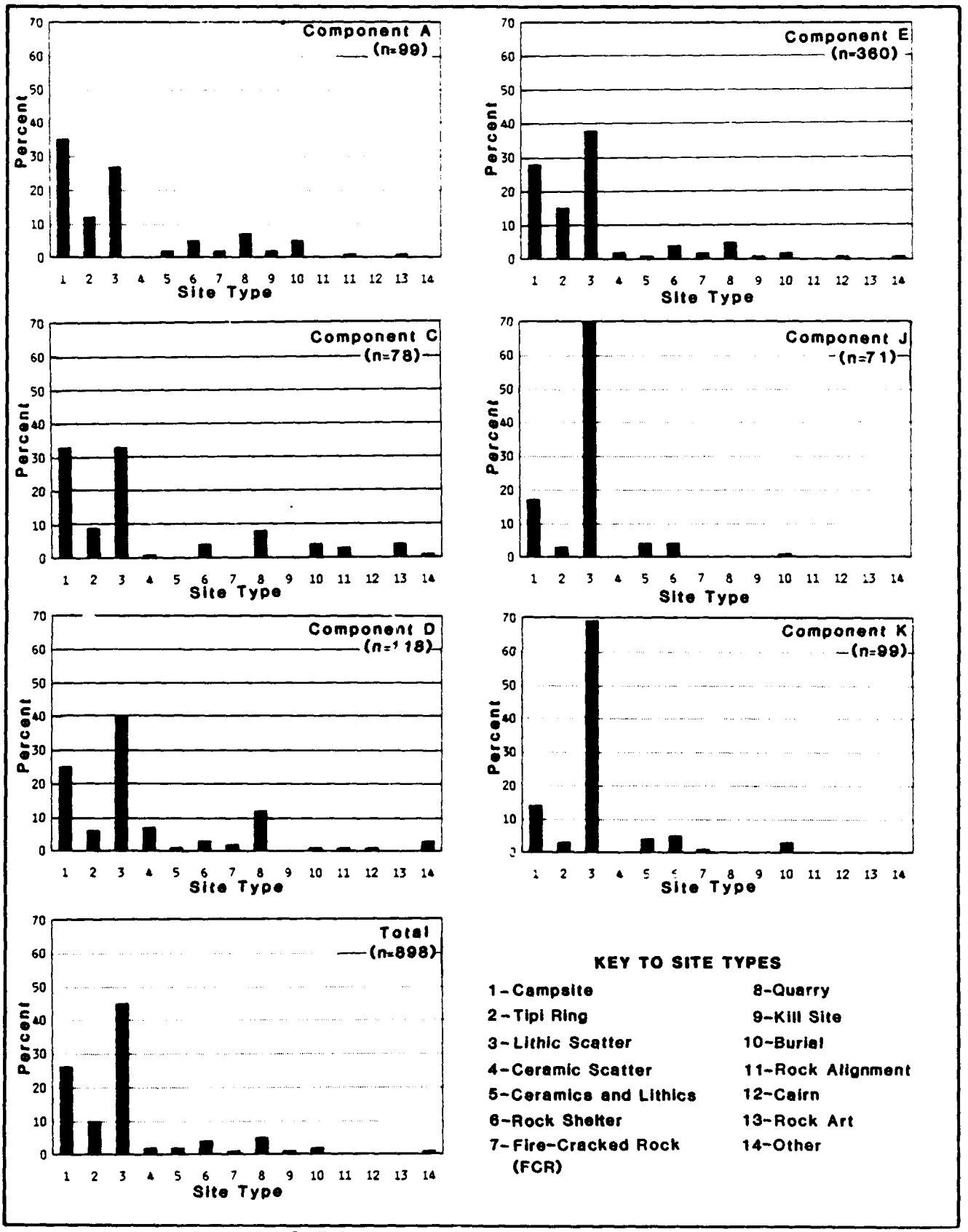
The most obvious conclusion to be drawn from the analysis is that the Mountain and Plains/Piedmont complexes differ dramatically in their respective site type distributions and that intracomplex variability is quite low. Whereas the Mountain landscape is characterized by a high percentage of lithic scatters and a relatively low frequency of campsites, the Plains/Piedmont area is typified by a much more even distribution in the frequency of these two site types. This disjunction between the two complexes supports the contention made by other researchers in the region (e.g., Reher 1977, 1982; Frison 1978) that indigenous populations made appreciably different use of the mountains and the plains. Because most of the sites classified as lithic

Table 2.6.2-5

FREQUENCY DISTRIBUTION OF SITE TYPES WITHIN LANDFORM COMPONENTS

Site Type	Landform Component[1]																		Total	
	A		B		C		D		E		H		I		J		K		L			
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Campsite	35	35	6	20	26	33	30	25	101	28	3	25	6	22	12	17	14	14	-	-	233	26
Tipi Ring	12	12	1	3	7	9	7	6	53	15	3	25	1	4	2	3	3	3	-	-	89	10
Lithic Scatter	27	27	20	67	26	33	47	40	138	38	2	17	18	67	50	70	69	69	4	100	401	45
Ceramic Scatter	-	-	-	-	1	1	8	7	9	2	1	8	-	-	-	-	-	-	-	-	19	2
Ceramic + Lithics	2	2	1	3	-	-	1	1	2	1	-	-	1	4	3	4	4	4	-	-	14	2
Rockshelter	5	5	-	-	3	4	3	3	16	4	1	8	-	-	3	4	5	5	-	-	36	4
FCR	2	2	-	-	-	-	2	2	8	2	-	-	-	-	-	-	1	1	-	-	13	1
Quarry	7	7	-	-	6	8	14	12	18	5	1	8	-	-	-	-	-	-	-	-	46	5
Kill Site	2	2	1	3	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	5	1
Burial	5	5	1	3	3	4	1	1	6	2	-	-	-	-	1	1	3	3	-	-	20	2
Rock Alignment	-	-	-	-	2	3	1	1	1	<1	-	-	-	-	-	-	-	-	-	-	4	<1
Cairn	1	1	-	-	-	-	1	1	2	1	-	-	-	-	-	-	-	-	-	-	4	<1
Rock Art	-	-	-	-	3	4	-	-	-	-	1	8	-	-	-	-	-	-	-	-	4	<1
Other	1	1	-	-	1	1	3	3	4	1	-	-	1	4	-	-	-	-	-	-	10	1
TOTAL:	99	99	30	99	78	100	118	102	360	100	12	99	27	101	71	99	99	99	4	100	898	99

Note: 1 See Table 2.6.2-4 for key to landform components.



FREQUENCY DISTRIBUTIONS OF PREHISTORIC SITE TYPES WITHIN SELECTED LANDFORM COMPONENTS

FIGURE 2.6.2-10

scatters probably are the product of activities centered around hunting of game, it seems reasonable to conclude that the mountain landscape was primarily used for this subsistence activity.

Finally, the current analysis suggests that important differences may exist in the degree and kind of site diversity between the two landscape complexes. Specifically, the Plains/Piedmont area is characterized by greater diversity in the types of sites represented in the inventory. For example, quarries, ceramic scatters, rock art (pictographs), kill sites, and cairns do not occur in the sample from the mountains but do occur in the lowlands. Although the number of cases involved in several of these categories is quite small, the data nonetheless suggest that the Plains/Piedmont area was used for a much broader range of cultural activities than mountainous areas. Again, this confirms conclusions drawn by other researchers in the region. This finding also has importance for any future resource inventory and evaluation efforts associated with the Proposed Action. Specifically, it is expected that the DA will contain numerous prehistoric sites of several different types and that many of these will be of NRHP-eligible quality. In addition, this same site inventory should provide considerable information about the range of cultural activities that have occurred over the millenia in the Plains/Piedmont portion of the region.

2.6.3 American Indian Cultural Resources

This section summarizes available information about the lifeways, technology, and settlement-subsistence patterns of American Indian groups who occupied the ROI during the period following Euramerican incursion into the area. Following this brief overview of Plains Indian culture, consideration is given to the kinds of American Indian resources known or expected to occur within the study area. It is important to note that these discussions are confined to the kinds of nondomestic American Indian sites encompassed by the resource element definition given in Section 1.2; treatment of domestic American Indian sites is provided in the section on historic cultural resources (Sections 2.6.3.2 and 2.6.3.3).

2.6.3.1 Overview

The following is a brief summary of Plains Indian culture within the ROI as reported in ethnographic, early historic, and archaeological accounts, beginning at the time of initial Euramerican contact until roughly AD 1850. Indian culture during this time was characterized by equestrian populations dependent mainly on bison for subsistence, warfare leading to group displacement, and increasing changes to traditional lifeways by white influence and pressure from the expanding American frontier.

A period exists prior to actual contact when indigenous populations possessed trade goods of Euramerican manufacture, but for which no written record exists. This time frame, designated as the Protohistoric period, begins in the study area around AD 1700, which roughly corresponds to the introduction of the horse to Plains Indian culture, and lasts until approximately AD 1800, when the Lewis and Clark expedition opened the area to fur trade and settlement.

2.6.3.1.1 Tribal Migrations

During the Protohistoric and early Historic periods, extensive tribal migrations took place, not only on the Plains but also in adjacent regions to the northeast and southeast. Evidence indicates that the ROI was occupied or used by a number of groups that represent five separate language families: Algonkian (Cheyenne, Arapaho), Siouian (Sioux, Crow), Caddoan (Pawnee), Athabaskan (Kiowa, Apache), and Uto-Aztecan (Shoshone, Comanche) (Murdock and O'Leary 1975).

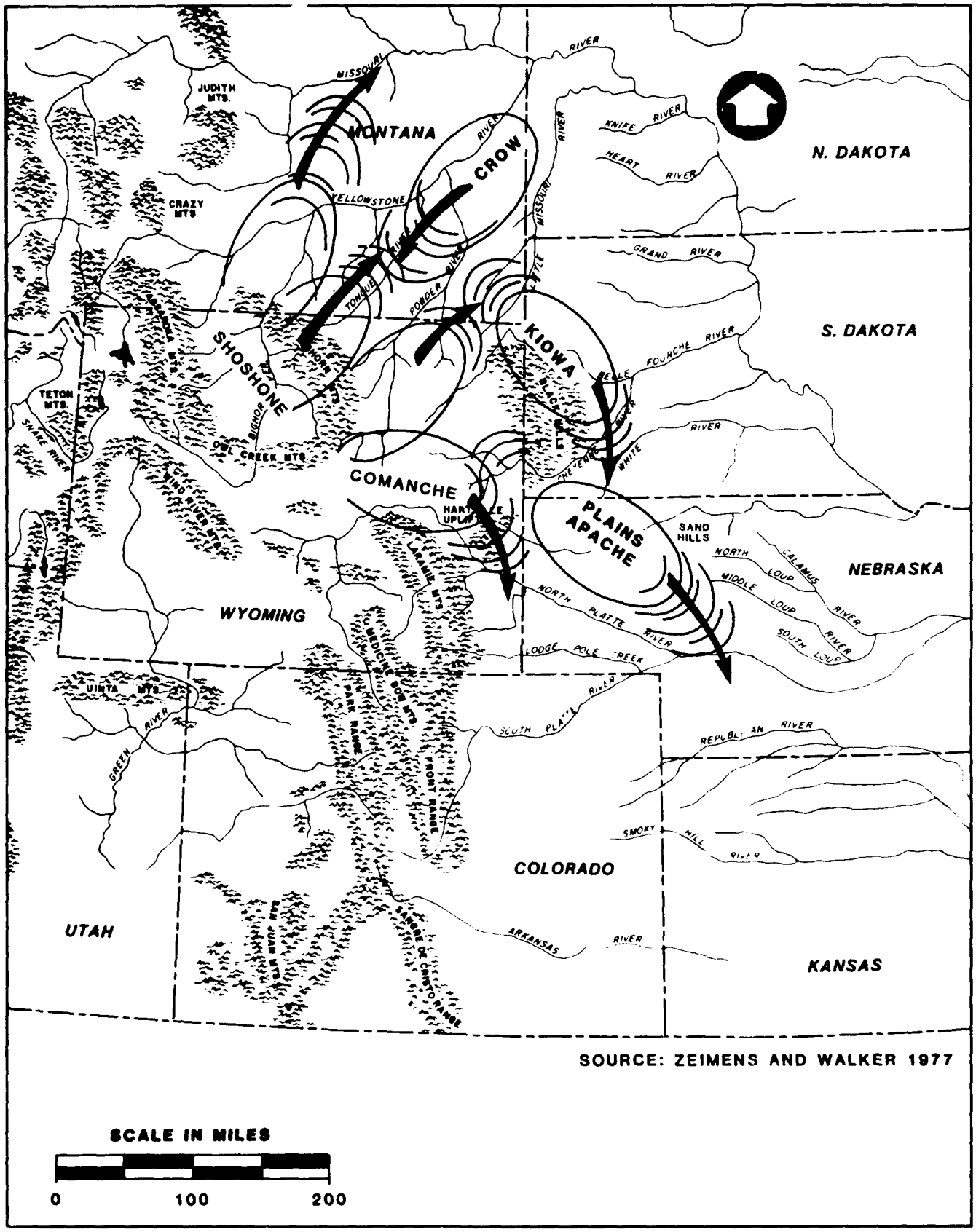
The Shoshone, having made their way east into the study area from the Great Basin during the Late Prehistoric period, continued to move north and east. Their presence in eastern Wyoming is suggested in the 1742 journal of the La Verendrys brothers. At the same time, the Comanches (Paduca) were moving south and east through the ROI, at the expense of the Plains Apache, who are thought to be associated with the Late Ceramic period Dismal River aspect, dating to AD 1650 to 1750. During the early 1700s, the Crow (Absaroke) were situated in the northern Powder River Basin, and the Kiowa controlled the Black Hills (Figure 2.6.3-1).

The Cheyenne (t sis tsis'tas), who lived as agriculturalists along the banks of the Missouri, were pushed out of the area by the Assiniboine, who had acquired firearms and were themselves being forced westward. The Cheyenne entered the Black Hills area, forcing the Kiowa southward and the Crow westward. Sometime in the middle 1700s, the Cheyenne extended south of the Black Hills, eventually becoming established on the North and South Platte rivers within the study area. Grinnell (1923) relates that the Suh'tai, a tribe related to the Cheyenne, apparently preceded the Cheyenne into the area west of the Black Hills and joined forces with them once they moved into the area.

The Arapaho (Inunaina), who initially resided in eastern Montana, were forced southward by the Sioux. Figure 2.6.3-2 indicates group movements in the region during roughly a 100-year period from AD 1700 to 1800.

A treaty council was held at Fort Laramie in 1851. In attendance were the Cheyenne, Arapaho, Sioux, Crow, Blackfoot, and Shoshone. This council provided for a division of the land east of the Continental Divide and north of the Arkansas River. A contemporary chronicler, Father De Smets, prepared a map describing the territory assigned to the tribes who were party to the Treaty. According to the map, the Cheyenne and Arapaho were jointly assigned the area between the North Platte and Arkansas rivers east of the Continental Divide in Colorado (Figure 2.6.3-3). The eastern boundary extended south from the junction of the North and South Platte rivers at present-day North Platte, Nebraska, to the Arkansas River at present-day Dodge City, Kansas.

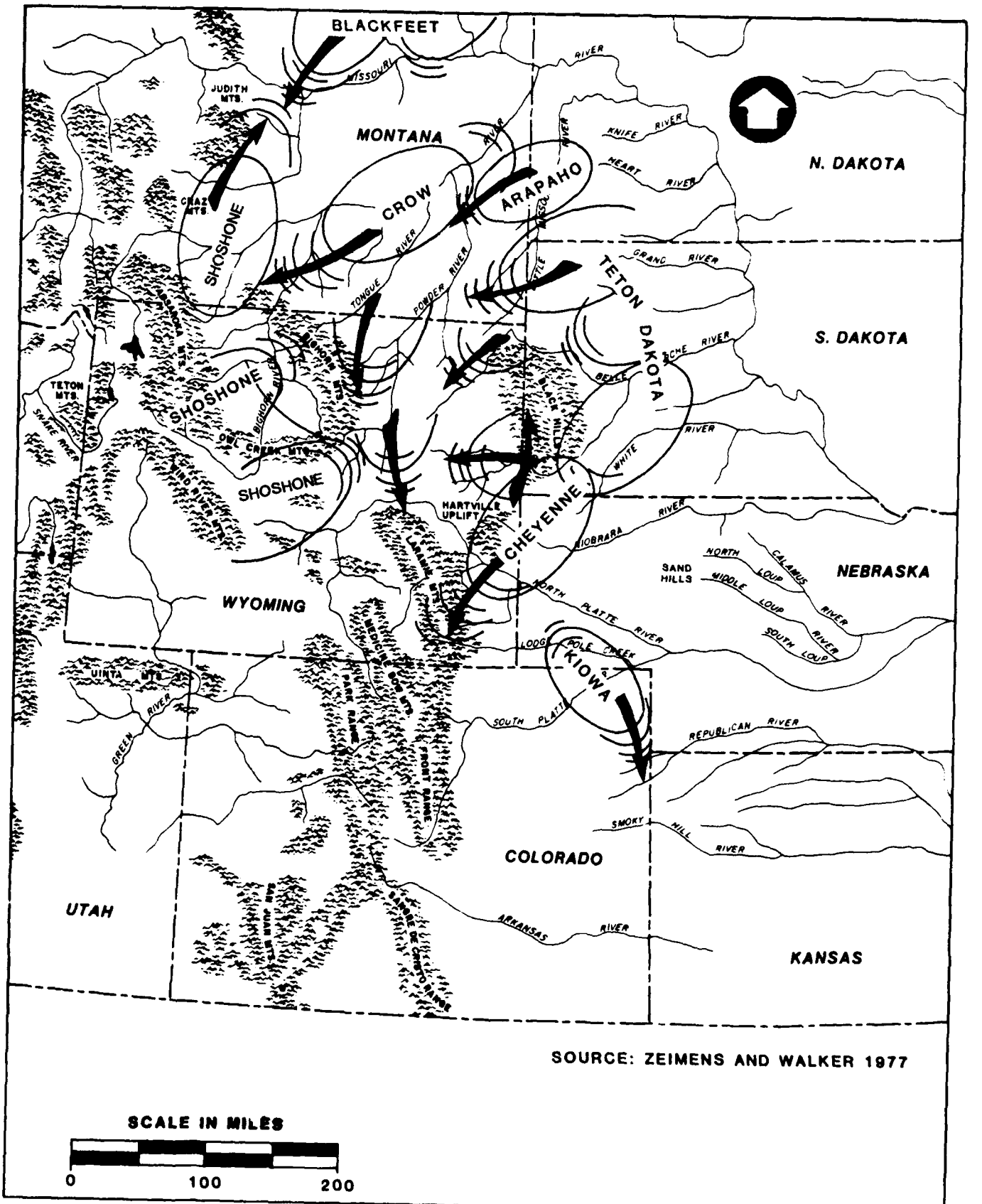
By 1861, the Cheyenne and Arapaho were assigned a small area of their former territory in southeast Colorado, bordered on the south by the Arkansas River. Following the Sand Creek massacre in 1868, the majority of the Cheyenne and Arapaho were relocated to Oklahoma. In 1878 to 1879, a band of Northern Cheyenne fought their way northward to Montana, where they established residence on the eastern margin of the Sioux Reservation. The Southern Cheyenne remained in Oklahoma, and the Arapaho joined the Shoshone in 1876 on the Wind River Reservation in central Wyoming.



SOURCE: ZEIMENS AND WALKER 1977

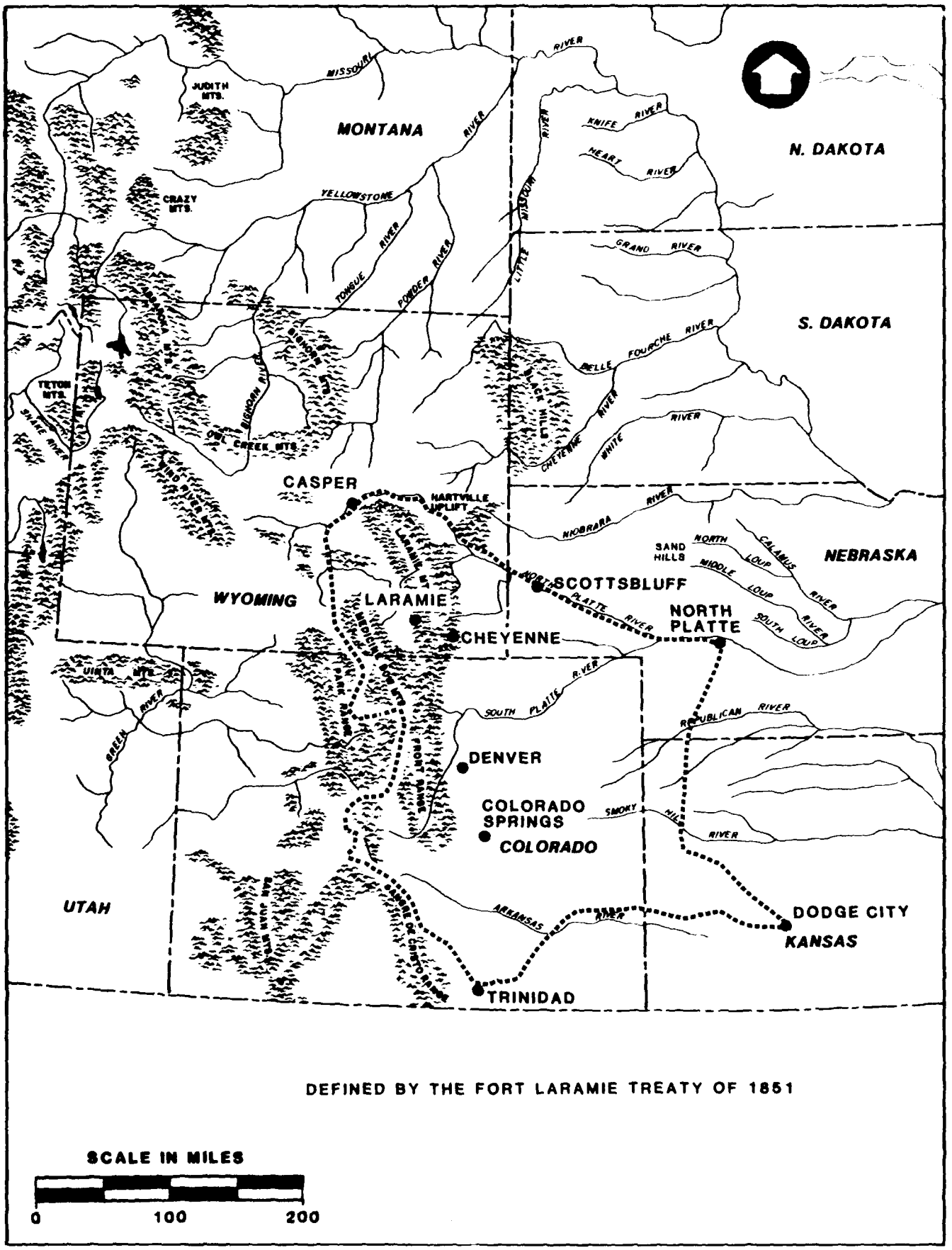
DISTRIBUTION OF AMERICAN INDIAN GROUPS IN THE ROI (AD 1600-1700)

FIGURE NO. 2.6.3-1



DISTRIBUTION OF AMERICAN INDIAN GROUPS IN THE ROI (AD 1700-1800)

FIGURE NO. 2.6.3-2



CHEYENNE AND ARAPAHO TERRITORY (1851)

FIGURE NO. 2.6.3-3

2.6.3.1.2 Intertribal Relations

Extensive intertribal warfare is one of the predominant traits of Plains Indian culture during the early Historic period. Oswalt (1973) believes that the underlying causes were primarily economic. Expanded hunting territories, afforded by the use of the horse, and the increasing encroachment of frontier settlement, causing new groups to migrate into the area, resulted in decreasing territory and increasing competition over available resources. He notes that conflict was particularly prevalent at the edges of the Plains, where bison were less abundant. Lowie, viewing the surface manifestations of the conflicts, determined that the chief motives for warfare were "revenge, horse lifting, and the lust for glory" (Lowie 1963:114).

While the Cheyenne were at the center of much of the warfare that occurred on the Plains during this time, they were closely associated with the neighboring Arapaho for many years. They often camped together for extended periods and frequently united in war; the Arapaho, on occasion, served as peace mediums with other tribes. Cheyenne men often married Arapaho women, although the converse does not appear to have been common (Grinnell 1956).

Until 1840, the Arapaho and Cheyenne were actively at war with the Kiowas, Comanches, and Apaches, with only occasional periods of peace. Grinnell (1956) suggests that this conflict probably arose from the need for horses. The Kiowas and Comanches acquired large herds by raiding into Texas and New Mexico. In turn, these were taken by the Cheyenne and Arapaho, whose herds were taken by the Pawnees and other tribes to the north. Thus, the horse steadily made its way into Plains culture.

After the Kiowas had been pushed south by the Cheyenne, they frequently made trips north to visit the Crow, who were also at war with the Cheyenne. In order to do so, the Kiowa had to traverse Cheyenne-Arapaho territory. In making this journey, they kept close to the flanks of the mountains to avoid their enemies, who usually camped well down on the plains.

The Cheyenne were also at war with the Pawnee to the east and the Ute to the west. On the few occasions when the Cheyenne and Blackfoot came into contact, they also fought, and a few cases have been reported of battles between the Cheyenne and Shoshone. The Cheyenne usually were on good terms with the village tribes of the Missouri, although occasional quarrels did occur.

2.6.3.1.3 Summary of Plains Indian Culture

The following description of Plains Indian culture, abstracted from Grinnell (1956), Wedel (1961), and Lowie (1963), provides a framework for interpretation of the types of cultural remains known and expected to occur in the ROI.

2.6.3.1.3.1 Social Organization

The nuclear or extended family was the basic social unit of Plains Indian society. In turn, groups of families formed bands that are defined by Lowie (1963:92) as "local group(s) of people jointly wandering in search of sustenance." Initially, bands were based on a clan-like kinship unit, but, as populations increased, common territory defined their composition. Bands generally consisted of 100 to 200 members who often fragmented into smaller units depending upon season, local topography, and availability of

resources. Each band retained its distinctive identity by maintaining its own unique customs in certain areas of daily life (Hoebel 1960).

The next level of organization known for the Plains was the tribe, which was made up of a number of bands. The structure of the tribe included a tribal council. In the case of the Cheyenne, the Tribal Council consisted of 44 peace chiefs (Hoebel 1960) and in many respects was the most complex political structure in Plains Indian society (Zeimens and Walker 1977).

Apart from these ties, most Plains Indians were members of tribal associations or societies that served a variety of functions, both private and public. Warrior societies were particularly integral to Plains Indian culture. These and other societies enforced regulations during war, travel, and communal hunts. As time went on, increased warfare with other tribes and with frontier settlers added to the power of military societies. Other associations (e.g., age societies and sacred societies) each maintained particular rituals, stylized behavior, and regalia.

2.6.3.1.3.2 Settlement-Subsistence

The introduction of the horse to Plains Indian culture resulted in a series of changes in settlement-subsistence patterns. Its greatest impact was in providing the means for increased tribal mobility, thus affecting group size and seasonal aggregation and dispersion. New hunting techniques also were made possible (Mulloy 1965). Although a subsistence system highly dependent on bison exploitation continued, hunting territories were expanded, and bison were easily dispatched from horseback. Throughout the spring, summer, and fall, bands followed herds, eating some of the meat immediately and storing the remainder for winter use.

Buffalo drives continued, and by this time had reached substantial proportions; they took place on horseback or on foot using a variety of techniques. The surround technique became increasingly popular with the introduction of the horse; mounted hunters surrounded the herd and dispatched the animals using bow and arrow. Lowie (1963) describes one method of impounding whereby a corral was constructed that had an opening that was approached between two converging lines. These lines were formed by a solid fence near the entrance and rock or brush piles farther away. As many as 600 buffalo could be taken using this technique. These drives sometimes included as many as 200 people, which was the largest gathering during the seasonal subsistence round. Directors of such activities issued orders that had to be strictly obeyed and rituals were performed to ensure success.

Besides buffalo, other large game (e.g., antelope, deer, elk, and sheep) formed part of the diet of most groups. According to Grinnell (1956), the Cheyenne, who previously had been semisedentary horticulturalists before migrating to the Plains, learned to trap large numbers of antelope in pits by observing the Kiowa and by observing traps made by others. Horse and dog meat were eaten by some groups, and fish were caught on occasion, at least when food was scarce; pond turtles were roasted or boiled.

Except for the limited cultivation of tobacco by some tribes, agriculture apparently was not practiced by Indian groups in the study area. Maize was obtained by trade or theft from neighboring agricultural groups. As early as 1541, members of the Coronado Expedition found Plains tribes bartering their "cloaks" for maize. During the time of Lewis and Clark's travels, the

Cheyenne traded buffalo meat and robes for Arikara corn and beans. Horses and Euramerican trade goods also were considered appropriate barter for agricultural products (Lowie 1963).

Wild fruits, berries, roots, and tubers were an essential part of Plains Indian subsistence and were used for other purposes as well, such as fibers, medicines, and dyes. The wild turnip (Psoralea esculenta) was a prized food. It grew in hard ground, the root extending several inches below the surface and was removed with digging sticks by the women of the tribe. The performance of mock battles pitting women against men accompanied these gathering forays. Other plant products included the wild onion, water chinquapin (Nelumbo lutea), and Apios tuberosa. To prepare the fruit of the prickly pear cactus (Optuna polyacantha), specially made deerskin thimbles were used to remove its spines. Also valued as food were milkweed buds, thistle (Arsium edule), and many varieties of berries. The chokecherry (Prunus melanocarpa) often was used in making pemmican.

An economy based on hunting and gathering required bands to disperse throughout the territory into smaller units for much of the year in search of food. Such units might include as many as 50 to 75 individuals or as few as a single family (Zeimens and Walker 1977). Groups united for communal hunts, and when provisions were ample (e.g., during the spring and summer), they united for social activities. In the winter, sheltered stream valleys or broken areas were sought that could provide water, wood, and forage for horses. A good location might be used year after year.

2.6.3.1.3.3 Ceremonialism

Ceremonial or ritual activities were an important aspect of Plains Indian culture and pervaded every sphere of tribal life. Many such activities were intimately tied to the various societies characteristic of the social structure. Observances could be simple and brief and involve only a limited group or a single individual, or they could be as elaborate as the Sun Dance, which involved the entire tribe, took weeks to prepare, and lasted for days. Rites associated with ceremonies often included offerings and prayers, the solemn unfolding of a sacred object, body or face painting, sweating, or singing sacred songs.

As part of ceremonial life, the Cheyenne possessed two great medicines or protective charms: the medicine arrows and the buffalo cap or sacred hat. These were the most sacred objects owned by the tribe, and the associated ceremonies of renewing the arrows and of unwrapping the sacred hat were two of the most important, as was the ceremony of the massaum, or hunting ritual. The Arapaho held a "flat pipe" as their tribal fetish. It was invoked for long life and happiness, and offerings might be presented; it was specially stored and handled.

Another important aspect of tribal ceremonial activity was the manner of treatment of the dead; a number of burial practices have been observed for those groups that used the study area. Lowie (1963) reports that below-ground interment at a depth of about 5 feet was most common. Another burial practice, which Lowie claims was performed when the ground was frozen too hard for digging, was tree and pole scaffold burials. Bushnell's (1927) report of Plains Indian burial techniques suggests that this method was fairly common, at least for the Cheyenne, Arapaho, Crow, and Oglala and Brule Sioux. Fort Laramie was a favored place for this type of burial. For example, in 1866,

the daughter of Spotted Tail, one of the great Brule chiefs, was interred on a scaffold near Old Smoke, who also was at one time a great chief. On occasion, the Oglala also placed their dead on tree scaffolds near the fort in the hope that these burials might thus be protected from disturbance by an enemy. Nevertheless such precautions apparently were ineffective. Late in the spring of 1846, Francis Parkman, who was traveling through the area, on more than one occasion witnessed Crow Indians throw burials from scaffolds and break them to pieces while the Dakota stood helplessly by (Bushnell 1927).

The dead also were buried in caves or crevices in rocks or placed directly on the ground with a stone cairn piled over the body. The Oglala often abandoned their dead, and, in some instances, their dying as well, when a village was moved. Among the Sioux in Wyoming and Nebraska, it is reported that when a person died, a small scaffold was erected inside the dwelling and the body wrapped in skin and placed inside. Such burials were observed among the Cheyenne as well. According to Lowie (1963), a dying man might request to be placed inside a tipi set up on a hill. In such cases, the body was placed against a willow backrest and enclosed in a low stone wall built inside the tipi.

The body of a man who died in battle was left lying on the open plains, while a man wounded in battle, who died while being brought back to camp, was placed in a structure resembling a sweat lodge that was erected on the spot. His body was wrapped in blankets and placed on a bed of white sage, after which the shelter was covered with grass and bark (Bushnell 1927).

A man's war implements, pipe, tobacco, and other prized personal possessions usually were interred with the deceased. The body was clothed and decorated. If a man owned horses, often his best horse was saddled and bridled and shot near the grave. Mourning rituals accompanied death and burial.

2.6.3.1.3.4 Material Culture

The hunter-gatherer settlement and subsistence patterns of the Plains Indians required that material items generally be limited to those that could be easily transported by horseback or dog travois from camp to camp. Most material items found in Plains Indian assemblages prior to the widespread distribution of Euramerican goods were made of animal products, particularly buffalo. Hides were used for moccasins, parfleches, shields, receptables, and clothing, until trade cloth and blankets became more common in the nineteenth century. Horns of both buffalo and mountain sheep were used to make household utensils. Bones provided the material for tools (e.g., scrapers, fleshers, knives, and awls) (Berthong; 1963; Lowie 1963).

Dwellings. The tipi, which was a conical skin-covered tent, was used for at least part of the year. Tipis used in this area differ somewhat from those in adjacent areas because of their larger size and special smoke vent arrangement. Tipis with three-pole foundations provided the most stable arrangement and were used by the Cheyenne, Arapaho, Sioux, and others in Protohistoric times, while other groups from the northwestern foothills (e.g., the Shoshone, Crow) used a four-pole design (Brasser 1982). According to Brasser (1982), there is evidence that after the introduction of Euramerican goods, metal pegs were substituted for the stones that were used previously to hold down tipi covers, and Hoebel (1960) notes that, at more permanent camps, the floor of the tipi was excavated 4 or 5 inches below ground surface,

leaving a sod bench around the outer diameter. Temporary shelter might consist of a simple conical structure with a frame made of an upended travois (Ewers 1955).

Tools, Weapons, and Utensils. Bows, arrows, clubs, spears, and shields were the principal items used in hunting and warfare. Bows were made of wood; the juniper self-bow later gave way to the sinew-backed type. Also used were bow cases and armguards of animal skin. Projectile points were made of stone, bone, horn, and later, metal. After firearms were introduced, the bow still continued to be used because it proved to be more efficient when firing from horseback. Firearms, when desired, could be obtained at Bent's Fort, Fort Laramie, and elsewhere. As early as 1838, the Cheyenne obtained Hudson's Bay guns, flints, powder, and balls from Bent's Fort for the Battle of Wolfe Creek (Grinnell 1956).

Stone tools and utensils included flat slabs for grinding, mauls, and stone hammers that were grooved around the middle and hafted with rawhide to a wooden handle. Also used were arrow shaft straighteners, rock spall scrapers, and knives. After Euramerican contact, metal was used for the cutting edge on tools. Often, old gun barrels were split, opened, pounded flat, and then notched or toothed (Lowie 1963).

Clothing and Personal Adornment. Essential clothing, which included one or two-piece dresses and knee-high leggings for women, and deerskin aprons, breechcloths, leggings, shirts, and robes for men, were made of dressed skins. Moccasins were in general used by both sexes. The well-known war bonnet and buffalo horn caps were worn only on festive occasions, and headdresses were considered ceremonial regalia (Hoebel 1960; Lowie 1963). Many Plains Indian groups wore bear-claw necklaces, shell earrings and gorgets, and a variety of other articles, some indicating status. These objects were made by tribal members or obtained through trade from other tribes or white traders. Body and face paint also were used; red pigment was a preferred cosmetic.

Crafts. Skin dressing was the most highly developed Plains Indian craft. Porcupine quill embroidery, feathers, and painting were used for decoration. Bone awls and sinew thread were the basic tools used, and the Arapaho are known also to have used special quill flatteners made of bone or antler. Eagles were highly prized for their feathers and were caught from pit blinds.

Beadwork became prevalent after 1835 to 1840, when china and glass trade beads were introduced on a large scale. These early beads were nearly twice the size of beads introduced after 1850. During this time, new dyes were used for quills, and mocassins were sometimes decorated with cone-shaped tin tinklers, another trade item. Decorative patterns emphasized geometrical design; floral patterns were not used until well into the Historic period. Particular decorative patterns can be traced to specific tribes and, to some extent, specific time periods (Lowie 1963). The fur trade also influenced skin dressing by introducing iron blades for skin processing. Fur traders themselves desired dressed skins, which served as items of barter.

Other crafts such as woodworking, weaving, and basketry were of minor importance, although small, shallow, coiled basketry gambling trays were noted for the Pawnee, Kiowa, Comanche, Cheyenne, and Arapaho, among others. The Arapaho also used wooden mortars and bowls. Wooden cradle boards were widely used as well.

Other Items. The Arapaho, and perhaps others, are known to have had catlinite pipes, diffused from southwest Minnesota, as well as black stone pipes. Aside from the widespread use of the dog travois for mobility, Arapaho groups were known to wear oval snowshoes when they pursued game in the mountains. The use of horses resulted in additional items for their care.

Other items that were part of the Plains Indian material culture included gaming pieces, which consisted of stick dice, plum stones or bones, buckskin balls, perforated deer hooves, and phalangeal bones strung on a thong. Musical instruments included gourd rattles and wooden-framed rasp drums.

2.6.3.2 Summary of Known Resources

As noted above, several American Indian groups are believed or known to have occupied, used, or passed through the ROI and ACS during the Protohistoric and Historic periods. These groups include the Shoshone, Cheyenne, Comanche, Crow, Plains Apache, Kiowa, Arapaho, and Sioux. The Fort Laramie Treaty of 1851 assigned the area between the North Platte and Arkansas rivers east of the Continental Divide, which includes virtually all of the area encompassed by the ROI, to the Cheyenne and Arapaho jointly. Based upon their historic occupation of the area, interviews were conducted with representatives of both tribes to identify any locations of current or traditional cultural use. None of those interviewed was aware of any burial or "holy" places within the ROI.

Several American Indian sites dating to the Protohistoric and Historic periods are included in current resource inventories maintained by the Wyoming, Nebraska, and Colorado State Historic Preservation Offices. The overwhelming majority of these sites, however, are habitation loci and are therefore considered as a component of the historic cultural resources element. Those sites included in these inventories that are not habitation loci have not been attributed to any particular tribal group.

2.6.3.3 Summary of Expected Resources

American Indian cultural resources that may occur in the ROI and ACS would include cultural phenomena such as stone circles and burial locations. Natural and biological resources could include minerals and plants important in medicines and ceremonies. The likelihood of encountering such resource localities in the ACS is assessed as low.

2.6.4 Historic Cultural Resources

As with both prehistoric and American Indian cultural resources, relatively little previous systematic research has focused on the historic cultural resources of the ROI. Although numerous written accounts describe historical events and persons responsible for shaping the modern cultural landscape of the region, few address the humanistic or scientific values vested in the archaeological and architectural records constituting the physical remains of past cultural activity. Statutes and regulations put into force at the federal and state levels during the past two decades, have begun to direct attention towards preservation and conservation of these resources. Within the ROI, this has included archaeological reconnaissance and excavation (Todd et al. 1977; Blatchley and Welty 1980; Rosenberg and Greer 1981), architectural inventory, and documentary overviews (e.g., Jewell 1968, O'Neal 1981). Although these investigations are by no means comprehensive, information resulting from them provides a fairly broad-based perspective of

the types of historic resources that may occur in the region from approximately AD 1800 through the era of the Great Depression in the 1930s (Figure 2.6.4-1).

2.6.4.1 Overview

2.6.4.1.1 Early Spanish and French Influence

Although situated far north of the seat of government of the Spanish Empire in North America, and on the outer fringes of French penetration from the Mississippi Valley on the east, the ROI came under the influence of both nations through trade and indirect contact by the seventeenth century. The southern portion of the state of Colorado once represented the northernmost frontier of the Spanish Empire in North America. Beginning with the campaigns of Cortez in Mexico (1519-21), Spain gradually extended her sphere of influence into the area from Mexico City in search of mineral wealth and in hopes of converting the natives to Christianity.

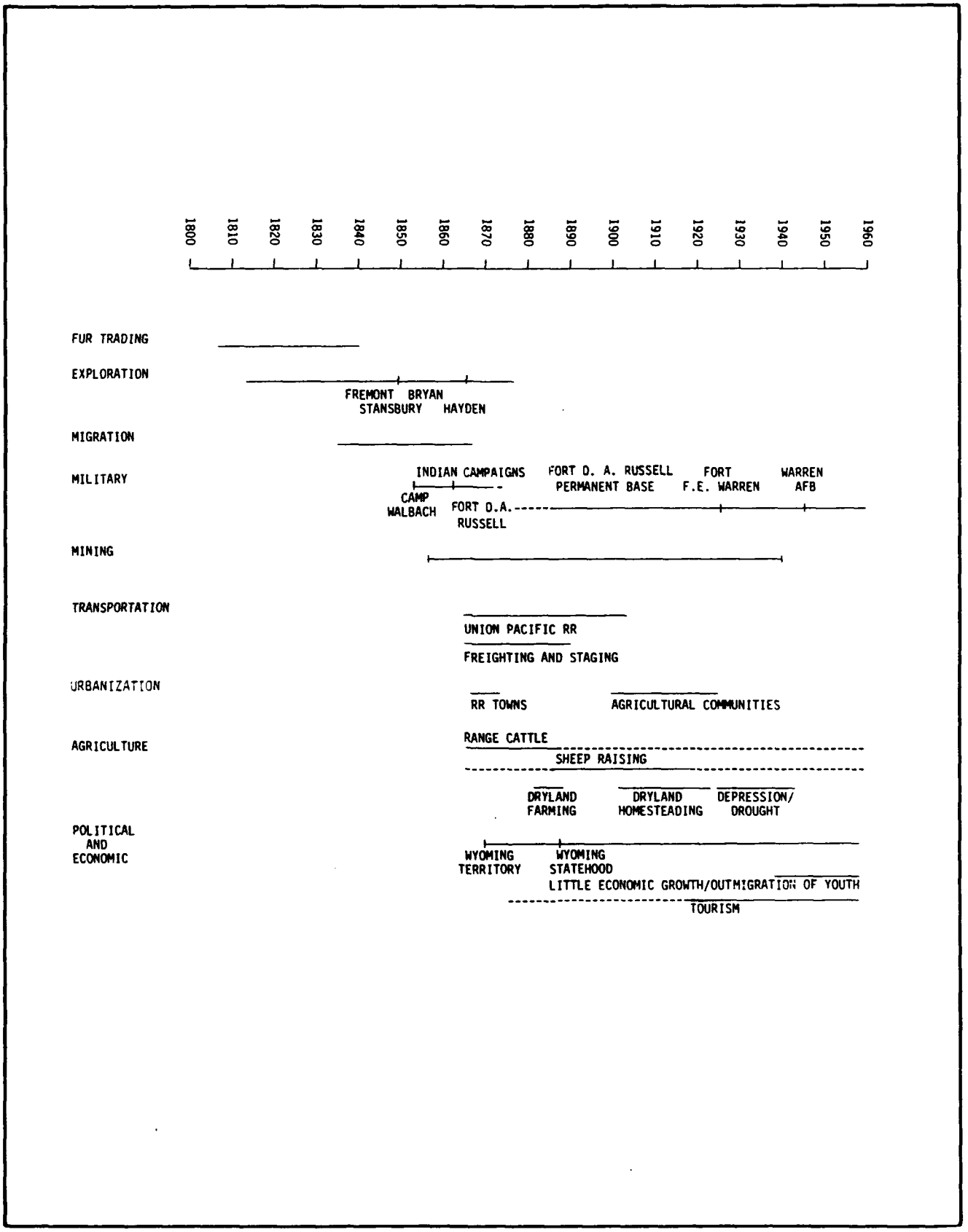
As early as 1664, the Spanish were concerned about the French working their way up the various western tributaries of the Mississippi and trading with the Indians. This concern resulted in the Villasur expedition in 1720 to reconnoiter enemy positions on the Northern Plains. Traveling north from Santa Fe through present eastern Colorado, Villasur found the South Platte River and followed it eastward to the area of the forks. Here he was attacked by Pawnees armed with French weapons, and he and most of his command were wiped out. Dealt a crushing blow, the Spanish briefly considered establishing an outpost farther north to guard the region against the French. The French, meanwhile, lost their hold on North America by the Treaty of Paris in 1763, ceding all land west of the Mississippi to the Spanish. In 1800, the area was ceded back to Napoleon who, realizing that it had become impractical to rebuild the French Empire in North America, in turn negotiated the Louisiana Purchase in 1803 with the United States.

While Lewis and Clark explored the northern portions of the Louisiana Purchase, an expedition led by Zebulon Pike set out in 1806 on a southwestern journey. Following the Arkansas River, Pike constructed a log fort near present-day Pueblo and penetrated the Front Range before he and his party were captured by the Spanish. After release, he published a report of his expedition in 1810, the first to describe this portion of the new American acquisition (Ubbelohde et al. 1972:20-22; Rosenberg 1976:12-13).

Years passed before another expedition was organized in 1820. This effort was divided into two groups: the military phase was conducted by Col Henry Atkinson and the scientific phase by Major Stephen H. Long. Long's party traveled along the north side of the Platte River to its forks, then crossed to the south side, traversing the ROI along the South Platte River past the present-day sites of Greeley and Denver. His expedition accomplished little, and Long undoubtedly helped to retard the development of the American West by referring to the region east of the mountains as "the Great American Desert" (Olson 1955:46-47; Ubbelohde et al. 1972:25-29; Rosenberg 1976:14).

2.6.4.1.2 The Era of the Fur Trapper and Early Explorations

Although the ROI lay far from the main western fur-trading centers, it was used and influenced by the Taos trade to the south and the Missouri River trade to the north. Taos served as a natural base of operations for trappers



DEVELOPMENT OF HISTORIC THEMES IN THE ROI

FIGURE NO. 2.6.4-1

in the central and southern Rockies, especially after Mexican independence in 1821. Although the Taos trappers tended to work the streams of what became the southwestern United States, they often ventured as far north as the Green River country and trapped in the mountain streams along the Colorado Front Range (Weber 1971).

Even before the return of the Lewis and Clark Expedition from the Louisiana Territory, large fur companies had been attracted to the Northwest with posts at Astoria, Oregon and Fort Hall, Idaho. John Jacob Astor operated the American Fur Company from Fort Union on the Yellowstone River. In 1810, Astor dispatched a land and a sea expedition both bound for the mouth of the Columbia River, to establish the headquarters of an envisioned chain of trading posts stretching from the Great Lakes to the Pacific Ocean. The overland party, led by Wilson Price Hunt, attempted to find an alternate route to the Lewis and Clark passes to bypass hostile Indians. Hunt's party crossed present-day Wyoming, entering from the northeast corner and exiting via Teton Pass on the western border. More importantly, an eastbound party returning from Astoria in 1812, under the leadership of Robert Stuart, is credited with the discovery of the great South Pass. Stuart's party continued east along the North Platte River, camping near Casper, Wyoming, and Scottsbluff, Nebraska. Not only did the Stuart party discover South Pass but it traveled west to east along a large portion of what later would become the Oregon Trail (Rollins 1935; Rosenberg 1981:2-3).

South Pass remained in obscurity until 1824 when it was rediscovered by the Ashley Party led by Jedediah Smith, looking for a watershed crossing of the Wind River Range in winter. Thereafter, the pass was used commonly by mountain men and became well known to travelers. In 1830 Smith, David E. Jackson, and William L. Sublette took a caravan of wagons loaded with trade goods along the eastern portion of the future Oregon Trail as far as South Pass. They did not cross the pass but proved the route feasible for wagon migration, at least to that point. In 1832, Captain Benjamin L.E. Bonneville led the first wagons across South Pass into the Green River Basin, proving the practicality of the pass for wagon travel. Thus, the fur trappers and traders had not only discovered the essential Oregon Trail corridor but proved its ability to accommodate wagon traffic.

Information about trapping activity in the ROI is sketchy because the mountain men were seldom concerned with leaving accurate accounts of their explorations. John Colter trapped in northern Wyoming in the winter of 1807-1808, and the Ezekiel Williams party, forced south from the Yellowstone country by Blackfoot Indians, either crossed the Snowy Range in Albany County, Wyoming, or followed the North Platte River south into North Park, Colorado (Coutant 1899:70-73; Homsher 1949:3-4). Jacque Laramie, whose name is liberally used throughout the ROI, is reported to have trapped in the region in 1817. He was killed in 1820 or 1821 after setting out alone to trap along the Laramie River (Homsher 1949:4).

The fur trade flourished between 1820 and 1840 after a period of decline during the War of 1812. While fixed fur forts had been used by the Missouri Fur Company and the American Fur Company on the Missouri River, it remained for William Ashley to initiate the rendezvous system while attempting to exploit the Central Rockies. Setting out in November 1824 from Fort Atkinson, Ashley followed the Platte River to its forks, following the South Platte to the vicinity of present-day Fort Collins, then northward across the Laramie Range and Laramie Plains, skirting the Medicine Bow Range to the north (Dale

1918). He reached the Green River country by mid-April 1825 and divided his men into four groups for a season of trapping, with orders to meet near Henry's Fork in July. This inaugurated the rendezvous system of fur trapping in the Rocky Mountain West. In this way, Ashley obviated the need for defended posts in Indian country; the site could be moved each year to the best trapping grounds, and the furs were all gathered at one time, facilitating shipment (Rosenberg 1976:4).

At the heart of the fur trade, during its early years, was the beaver pelt. Beaver were plentiful throughout the streams and rivers of the Rocky Mountains. Their pelts were relatively small and easy to handle in shipping and could bring as much as $6 to $8 a piece at eastern markets. As beaver gradually were trapped out, and eastern and European fashion changed, the buffalo hide became the foundation of the fur trade, not for fashion, but for leather belts used to run water-powered machinery of eastern American industries.

The ROI, while not considered prime trapping ground (except for western Albany County and western Larimer County), was used extensively as a route to and from adjacent trapping regions to the west, especially along the North and South Platte River corridors, which became portions of the Oregon and Overland trails. Fort Laramie (first known in 1834 as Fort William and later in 1841 as Fort John) was built at the junction of the Laramie and North Platte rivers by William Sublette and Robert Campbell "to control the fur traffic of a vast interior region" (Hafen and Young 1938:23). Actually, Fort Laramie represented a return to the fixed fur post concept and anticipated the decline of the beaver trade and the subsequent rise of the buffalo trade. The former industry had been carried on entirely by Euramericans, whereas the buffalo trade depended on the Indian. By design, Fort Laramie also was located advantageously in an area long recognized as excellent for trading with Indians.

Along with the decline of the beaver trade, additional fixed forts sprang up in the South Platte Valley in present-day Weld County, Colorado. Fort Vasquez was constructed near modern Platteville in 1835 by Louis Vasquez and Andrew Sublette. Fort Lupton followed in 1836, built by Lancaster P. Lupton to compete for the Indian trade. Fort Jackson was built by Henry Fraeb and Peter A. Sarpy in 1837 near Ione. Fort Lookout, later known as Fort George and Fort St. Vrain, was built by Bent St. Vrain and Company 6 miles northwest of Platteville to stem the competition from Forts Lupton and Jackson (Ubbelohde et al. 1972:40). Hafent (1928) and Krakel (1954) provide detailed discussions of the South Platte fur forts. They were located along a general trapper's corridor against the Front Range from Fort Laramie south to Bent's Fort. Just as the beaver trade declined, so did the buffalo trade, and all the South Platte Valley posts finally were abandoned. Forts Lupton and Vasquez, however, continued to serve as stage stations in the 1860s.

Fur trappers and traders were the first Euramericans to tap the resources of the West. According to the eminent Wyoming historian T.A. Larson, however, the economic importance of the western fur trade has been greatly overstated by historians. Furthermore, it is questionable just how abundant beaver were in many supposedly rich grounds throughout the Rocky Mountain West. The total workforce in what is usually considered the heart of the central fur trade, now Wyoming, probably never exceeded 500 men at its peak (Larson 1977:37). Others rate the historical importance of the fur-trapping era more highly. As Nebraska historian James C. Olson has observed: "the map of the West was

indeed first drawn on a beaver skin" (Olson 1955:43). Trappers, such as Jim Bridger, who survived the rigors and dangers of the early years, often became scouts, guides, or traders among the emigrant hordes that invaded the West. Such men carried mental maps of the entire Rocky Mountain West. Perhaps the chief importance of the fur trade is that these trapper-explorers provided the basic geographical information necessary not only for westward migration but also for more systematic exploration and exploitation.

Another aspect of the trapping era was its impact on indigenous cultures. Liberal amounts of watered-down alcohol, basic to the Indian trade, tended to undermine tribal structures. Venereal disease was common, and smallpox eradicated entire groups. Trade goods that the native populations were incapable of producing suddenly became impossible to live without. In summary, it became impossible for the American Indian to maintain the lifestyle that had been pursued previous to Euramerican influences (Lau and Rosenberg 1982:70).

2.6.4.1.3 Post-Fur Trade Explorations: The Military and Scientific Frontiers

Prior to building extensive systems of forts, roads, and telegraph lines, the U.S. Army realized the need to reconnoiter vast and unknown regions of the West. The Corps of Topographical Engineers, under Col J.J. Abert, sent numerous expeditions west in the 1840s and 1850s to gather both military and scientific information. Perhaps the best known explorer of this era was John C. Fremont, "the Pathfinder." Fremont generally followed already well-established trails. With his gift for writing, together with political connections to diffuse his information, his exploits were immortalized. In 1842 Fremont proceeded up the South Platte to Fort St. Vrain, then traveled north to Fort Laramie along the eastern base of the Front Range and the Laramie Mountains. He continued westward on the new Oregon Trail, carefully mapping as far as South Pass for emigrant parties (Fremont 1845; Goetzmann 1959). In 1843 Fremont followed Asley's general route through the ROI, attempting to penetrate the Front Range to find a suitable westward passage for emigrant travel. Few men were familiar with this particular area, even at this relatively late date. Fremont explains:

> It is singular that, immediately at the foot of the mountains, I could find no one sufficiently acquainted with them to guide us to the plains at their western base; but the race of trappers, who formerly lived in their recesses, has almost entirely disappeared - dwindled to a few scattered individuals - some one or two of whom are regularly killed in the course of each year by the Indians (Fremont 1845:120).

Fremont had to employ the services of Alexis Godoy, even though two of the most famous mountain men (Kit Carson and Tom Fitzpatrick) were already members of his party. They attempted to follow the Cache La Poudre River upstream, but eventually headed northward through mountains and foothills to enter the Laramie Plains from the west. They camped on the Laramie River on July 31, 1843, and traveled across the Laramie Plains along the east base of the Medicine Bow Mountains. The party then skirted the mountains to the north, crossed the North Platte River, and finally proceeded in a northwesterly direction to the Sweetwater River and South Pass (Fremont 1845:125-127).

Fremont's chief contribution was to record conscientiously and map his travels. He also tapped the memories of surviving fur trappers, recording their information for posterity. Goetzmann (1959:89) states: "This was one difficulty with the specialized geographical knowledge which the mountain man possessed: it could die with him."

In 1850 Howard Stansbury traveled portions of what would become the Overland Trail, a southern alternative to the Oregon Trail. This important expedition is discussed in more detail in Section 2.6.4.1.4. In 1856 Lt F.T. Bryan was ordered to find a suitable wagon road from Fort Riley, Kansas, to the Salt Lake Valley using Bridger's Pass. At this time, the federal government was concerned with what it considered to be the growing Mormon problem and the possibility of open conflict. In the ROI, Bryan followed Stansbury's route, as far as Bridger's Pass, to determine its feasibility for wagon travel. He improved portions of what became known as the Lodgepole Trail on its ascent of the Laramie Range (U.S. Congress 1857:459). John Bartleson traveled eastward on the same route in December 1857 under orders from Col Albert S. Johnston, to determine the possibility of moving troops from Fort Bridger to Fort Laramie (U.S. Congress 1859). Randolph B. Marcy, who later wrote an emigrant guide for the U.S. Government, also crossed the route in 1858.

Other expeditions of the Corps of Topographical Engineers included Lt Kemble Warren in 1857 and Captain William F. Raynolds in 1859. Warren's goal was to reconnoiter the Black Hills area for future military operations against the Indians. Warren crossed the ROI when he re-outfitted at Fort Laramie, then struck northward to the Black Hills, generally along the future Cheyenne to Deadwood Stage Road (U.S. Congress 1859:630). As a result of Warren's expedition, another party was sent out in 1859 under Captain Raynolds to scout the Indians and explore four possible wagon routes. On his return from his first phase of reconnaissance in 1859, he followed the Oregon Trail eastward back from the Bighorn country and went into winter quarters on Deer Creek near Glenrock (Converse County). A detachment led by J. Hudson Snowden conducted a reconnaissance north from the Deer Creek camp in 1860 to Pumpkin Buttes, the Belle Fourche and Cheyenne River country, making a loop back to the North Platte River, where LaBonte Creek enters south of Douglas (U.S. Congress 1868:156-61).

Raynolds' survey was the last conducted by the Corps of Topographical Engineers. With the coming of the Civil War, attention was diverted eastward. The military showed a renewed interest in the ROI during the Indian wars that began at the close of the Civil War, using the information gathered during this frontier phase to conduct campaigns against the Sioux, Cheyenne, and Arapaho.

2.6.4.1.4 The Transportation Frontier

2.6.4.1.4.1 The Oregon Trail

By 1840 fur trappers and traders unwittingly had hastened their own demise by developing an east-west corridor fit for wagon travel across the Trans-Mississippi West. Popular interest had been aroused by the tales of returning Astorians, explorers, and mountain men of the vast empire that lay west of the Mississippi. By an 1818 convention with England the Oregon country became open for joint occupation by citizens of both countries, but it was not until 1846 that Oregon actually became a territory of the United States. The Oregon Trail allowed thousands of emigrants to enter Oregon and helped tip the

political balance for its acquisition by the United States. As a result of the financial panic of 1837, depressed farm prices, the social impact of the industrial revolution, and the eternal hope that life will be better elsewhere (usually west), thousands were willing to "take the jump" at Independence, Missouri, and cross the rolling prairie to the Great Platte River Road. The first organized emigrant group, the Bidwell-Bartleson party, left in 1841. The following year, John C. Fremont traveled a portion of the emigrant road, made the first accurate map, and wrote a guidebook for travelers. In 1843, 1,000 people were led westward by Marcus Whitman, who had already established a religious mission in Oregon. In 1847, the Mormon migration began, following the north bank of the Platte with the ultimate destination of the Salt Lake Valley. In 1849, the discovery of gold in California provided an additional catalyst; approximately 30,000 emigrants passed through Fort Kearney and Fort Laramie that year (Mattes 1969:13-15).

The Oregon Trail entered the ROI at the southeast corner of Scotts Bluff County. The Mormon Trail stayed on the north side of the North Platte River and passed through the site of present-day Scottsbluff. The main emigrant trail used the south bank until it approached the geographical feature of Scotts Bluff (named for an early trapper who died there). High bluffs and badlands forced wagon trains away from the river and over Robidoux Pass. After 1850, emigrants used Mitchell Pass, which was closer to the river and precluded the long jog to the south. It had not been passable for wagon traffic until improved with pick and shovel.

The Robidoux trading post and blacksmith shop was established in 1849 halfway up Robidoux Pass and catered to the emigrant traffic. Indeed, Robidoux's was the first Euramerican habitation for 300 miles west of Fort Kearney. Three Robidoux posts were built; the last was established in the mid-1850s to take advantage of the new route over Mitchell Pass. In addition, the American Fur Company, after relinquishing Fort Laramie to the Army in 1849, moved operations to the Scotts Bluff area. Its posts also were moved three times to compete with Robidoux and to accommodate the Oregon Trail traffic (remains of the second post have been located in Helvas Canyon off the Robidoux Pass route). A short-lived military post, Fort Mitchell, was located 3 miles west of the city of Scottsbluff in 1864 to protect the telegraph lines and overland mail service during the Sioux and Cheyenne disturbances. It was built of adobe and was abandoned by 1867. No trace remains of the fort today; however, foundation remains were measured in 1910, and these ground plan drawings still survive (Mattes 1969).

The Oregon Trail proceeded into the present state of Wyoming following the North Platte River across Goshen County to Fort Laramie. Fort William had been built in 1834 by Sublette and Campbell, and a rival fort known as Fort Platte was built by Lancaster Lupton in 1840. As a result of this competition, Fort William was rebuilt in 1841 and renamed Fort John. The original site of Fort William is not known, but the location of Fort John is known from military drawings. In 1849 Fort Laramie became a military post. It was rebuilt as one in a chain of such posts along the Oregon Trail to protect the emigrants. According to historical guidebooks, Fort Laramie was 665 miles west of St. Joseph, about one-third of the way to Sacramento. It represented the beginning of the mountains and the end of the more easily traveled plains. It was also the last outpost of civilization for the emigrant and provided a good turning back place (Hafen and Young 1938; Mattes 1969:480-521). From Fort Laramie the Oregon Trail proceeded north and west along the North Platte to Guernsey, site of the emigrants' Register Cliffs (an

imposing series of wagon ruts carved into the sandstone outcroppings by countless iron rims). The trail then continued as several tracks along the south bank of the Platte, past what are now the Guernsey and Glendo reservoirs, leaving the ROI in the northwest corner of Platte County.

In addition to its use as an emigrant trail, the Oregon Trail was the route for the first transcontinental telegraph line, built in 1861. Edward Creighton was in charge of construction from Omaha to Salt Lake City (Thompson 1947:361). The entire telegraph system was constructed in just over 4 months. In 1865 and 1866, Creighton and C.H. Hutton built a second telegraph line, from Denver to Salt Lake City, along the Overland Trail (Coutant 1899:374).

The federal government began subsidizing the overland mail in 1859 and the Pony Express in 1860. Russell, Majors, and Waddell of St. Joseph, Missouri, organized the Pony Express. This attempt at increasing the speed of mail delivery was to last 17 months. The mail took only 8 to 10 days from St. Joseph to Sacramento (Kuykendall 1917:62) but could not compete with the overland telegraph system. The Pony Express and overland mail systems included several stations along the Oregon Trail and within the ROI. From east to west, these stations were: Ficklin Springs Station (near Fort Mitchell, 3 miles west of Scottsbluff), Horse Creek Station (2 miles northeast of Lyman), Cold Springs Station (2 miles southeast of Torrington), Verdling's Ranch Station (2 miles west of Lingle), Fort Laramie Station (undetermined point west of Fort Laramie), Sand Point Station (the base of Register Cliff, Platte County), and Horseshoe Stage Station (south of Glendo).

2.6.4.1.4.2 The Overland Trail

In addition to the Oregon Trail, the transportation frontier is represented by the Overland Trail. One of the major routes in the Trans-Mississippi West between 1862 and 1869, it was used by westward bound emigrants long after the completion of the transcontinental railroad. The Overland Trail was well known to early fur trappers and traders, and portions of it had been followed by Ashley (1825) and Fremont (1843). Its value as an emigrant route first was recognized officially in 1850 by Captain Stansbury of the Corps of Topographical Engineers. Returning from a survey of the Salt Lake Valley, he was guided along the route east of Fort Bridger by Jim Bridger. Used in conjunction with the Lodgepole Trail across extreme eastern Wyoming Territory and the Nebraska Panhandle, it offered a route about 60 miles shorter than the Oregon Trail to the north. Variations of this route were used by Cherokee Indian parties bound for California, as well as by the military, who gradually improved portions of the route (e.g., the Bryan and Bartleson expeditions). Ben Holladay used the route starting in 1862 for his overland stage and mail line. This route diverged from the Oregon Trail near present-day North Platte, Nebraska, and followed the South Platte River to Julesburg, Colorado.

The South Platte portion of the route was heavily used by gold-seekers during the 1859 Pikes Peak gold rush to Colorado. The route continued along the river to Latham (near Greeley), where it turned northwest and followed the Cache La Poudre River to La Porte (north of Fort Collins). From LaPorte, it followed modern U.S. Route 287, crossing the Laramie Range to the Laramie Plains. It skirted the Medicine Bow Range to the north around Elk Mountain (leaving the ROI) and crossed the North Platte River and the Sierra Madre Range via Bridger Pass. It continued westward across the Washakie Basin, picking up the Bitter Creek drainage to the Green River and joining the Oregon

Trail near present-day Granger, Wyoming. Stage stations were established at regular intervals. Holladay, realizing that the days of the Overland were numbered with the steady advance of the first transcontinental railroad, sold his holdings in 1866 to the Wells Fargo Company, which suffered heavy losses when the railroad was completed in 1869. Hafen (1926) and Root and Connelly (1901) provide detailed histories. Although the Overland stage era was ended, emigrants continued to use the route for an undocumented period of time. Dr. J.H. Finfrock, Post Surgeon at Fort Halleck (built along the Overland to protect travelers from Indians), recorded the passing of 17,584 emigrants and 50,000 head of livestock in the year 1864 (Barnhart 1969:64). This indicates that the Overland Trail was a major emigrant route that offered military protection and regular water and aid stops at the stage stations (Rosenberg and Kvietok 1981).

2.6.4.1.4.3 The Lodgepole Trail

Yet another major emigrant route, the Lodgepole Trail, is closely associated with the Overland Trail. Instead of following the Overland route along the South Platte River into Colorado, the Lodgepole Trail followed Lodgepole Creek westward from its junction with the South Platte near Julesburg. It followed the creek across the lower Nebraska Panhandle (through the ROI) across Kimball County, and into Laramie County, Wyoming. The trail crossed the Laramie Range via the headwaters of Lodgepole Creek. It then joined the Overland Trail at Fort Sanders, near present-day Laramie on the Laramie Plains. Captain Stansbury and Lt F.T. Bryan probably should be credited with the establishment of the route. Although Stansbury was injured east of the Laramie Range and could not proceed further, he established its practicality for wagon travel. Bryan physically improved the route for emigrants on its eastern ascent of the Laramie Range by moving boulders and cutting trees. This trail originally was an Indian route, and the name probably stemmed from Indians securing fine straight lodgepoles in the area. Stansbury (1853) and U.S. Congress (1857) provide good accounts of the Lodgepole Trail. Although current historic documentation concerning emigrant usage of the trail is scant, its practicality was proven when the Union Pacific used the route for its right-of-way in 1867.

2.6.4.1.4.4 The Transcontinental Railroad

Unlike the Oregon and Overland Trail systems, which merely filtered emigrants through the ROI to points west, the railroad became the chief catalyst in opening the region to settlement and economic exploitation. An interesting feature of the Union Pacific Railroad was its construction through undeveloped country. Farther east, railroad systems usually developed between existing large population centers. Railroad construction in Nebraska and Wyoming resulted in early settlements, coal mining, commerce, and ranching, all clustered along the right-of-way. Such towns as Sidney, Kimball, Pine Bluffs, Cheyenne, and Laramie owed their existence to the railroad. The Union Pacific, then, directly influenced the location of cities along its route and was a major factor in their eventual growth or decline.

Although the idea of a transcontinental railroad had been promoted as early as 1836, public and congressional interest was first aroused by the Fremont Explorations in 1842 and 1846. In 1853 a bill was passed that called for the appropriation of funds for explorations of different routes for a railway to the Pacific. The surveys were started by the Corps of Engineers that same year. The outbreak of the Civil War pointed out the need to link the Trans-Mississippi West with the rest of the Union to aid military mobility. The

secession of the southern states precluded the possibility of a southern alignment, which may have been the least expensive and shortest route (Hogg 1967:18). Indian hostility eliminated the northern route from St. Paul via the upper Missouri to Vancouver. The first choice was the fertile and well-watered Great Platte River Road, or Oregon Trail, which could utilize the Platte Valley as well as the coal reserves of southern Wyoming (although in Wyoming the right-of-way stayed south of the Oregon Trail, more closely paralleling the Overland). Although the Railroad Act was passed in 1862, actual construction did not get underway until after the Civil War. Far in advance of construction, survey crews determined the exact route from Omaha, across the Platte Valley, over the Laramie Range, across the deserts of Wyoming, and across the Wasatch Range to its coupling with the Central Pacific, which was being built from the West Coast.

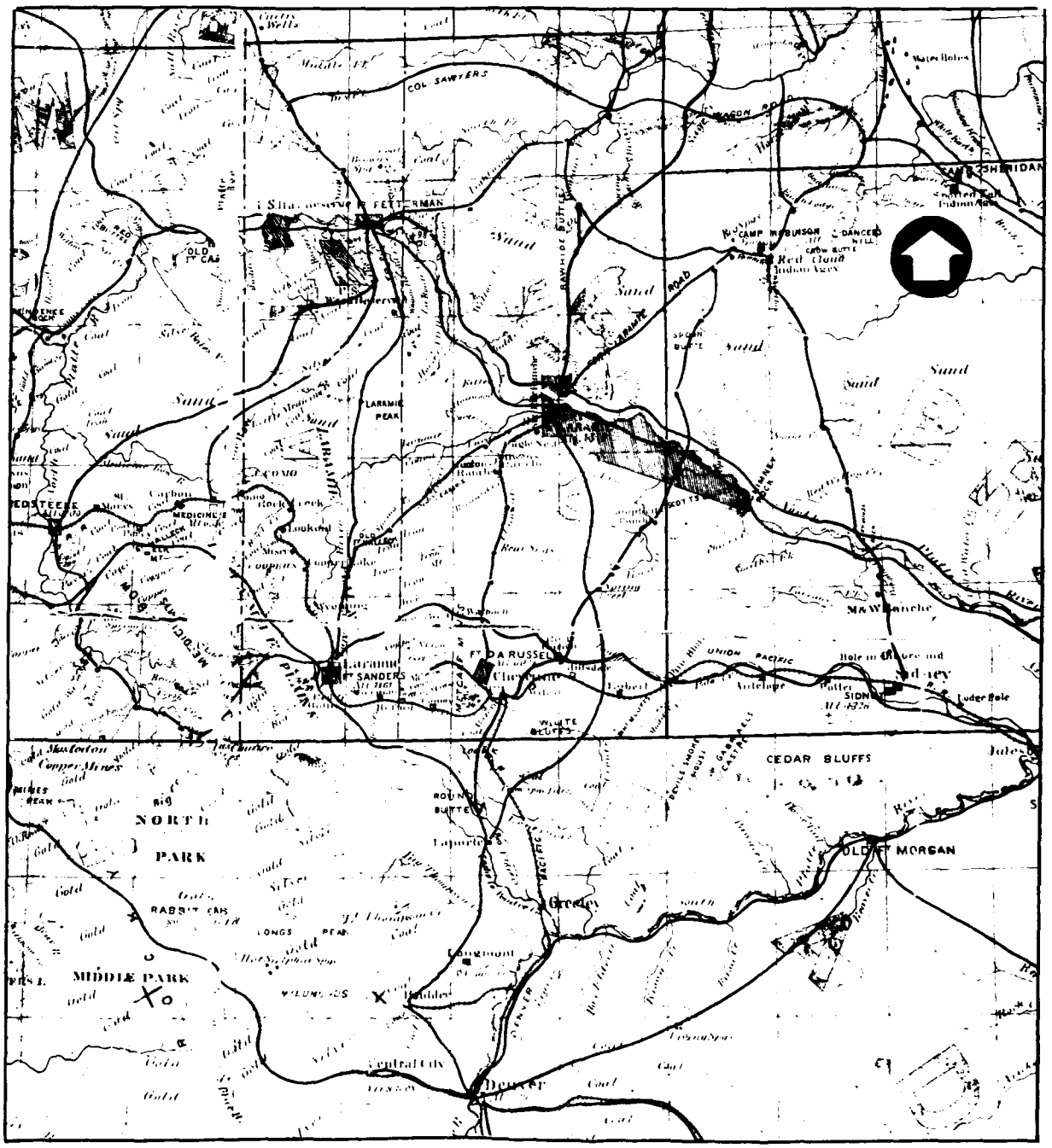
The railroad was completed to the North Platte in western Nebraska in the winter of 1866, and tracks reached the site of Cheyenne in November 1867. General Dodge, Chief Engineer of the Union Pacific Railroad, had determined the route over the Laramie Range in 1865 on his return trip from the Powder River Expedition. The final spike was driven on May 10, 1869 at Promontory Point, Utah. The Union Pacific portion had been built in 3 years, 6 months, and 10 days with a force of 10,000 men (Dodge 1910:32). Cheyenne housed the principal depot and repair shops and was the eastern base of the Rocky Mountain section.

The Union Pacific was granted alternate sections of land 20 miles on each side of the right-of-way. This acreage, coupled with federal homestead laws, provided the motivation to use this transportation system to reach and settle the wilderness. The impact of the Union Pacific on the ROI was great. It provided the necessary connection to eastern markets that were vital to ranching development, and it created a logging industry in Wyoming and Colorado because of the need for a continuous supply of railroad ties. Coal mines along the mainline were developed for railroad use as well as for nearby communities and provided steady jobs for thousands of miners. Dodge (1910) and Athearn (1971) provide excellent accounts of the building of the Union Pacific Railroad.

2.6.4.1.4.5 Cheyenne and Black Hills Stage Road

This important north-south route was developed as a result of the gold discoveries of the 1874 Custer Black Hills Expedition. The Black Hills, however, comprised an important part of lands set aside for the Sioux in the Treaty of 1868 and were closed to white travel. A military and telegraph route already existed between Fort D.A. Russell (near Cheyenne) and Fort Laramie (Figure 2.6.4-2). Stages ran every other day carrying passengers, mail, and express for military purposes along the route of the old trappers' trail from Fort Laramie to Bent's Fort in Colorado. A branch of this road continued from Fort Laramie to the Red Cloud and Spotted Tail Agencies in the northern Nebraska Panhandle (Spring 1949:17-38, Larson 1978:131-132).

Cheyenne was anxious to be linked directly to the goldfields. As early as March 20, 1875, Cheyenne businessmen had organized to promote the building of a more direct northerly route, using the existing road to Fort Laramie and then striking northward along the Wyoming Territorial boundary directly to the Black Hills. On November 11, 1875, Judge William L. Kuykendall of Cheyenne introduced legislation for "an act to locate and establish a territorial wagon road from Cheyenne to the Black Hills of Wyoming and Dakota" (Spring



SOURCE: Wyoming State Archives, Museums and Historical Department, 1983

MASI'S ITINERARY MAP OF WYOMING SHOWING RELIABLE ROUTES TO THE BLACK HILLS (1875)

FIGURE 2.6.4-2

1949:75). Although the government had not yet settled the issue with the Sioux, everyone proceeded as if the Black Hills were open to exploitation. The Fort Laramie bridge over the North Platte was completed in December 1885, removing the greatest single obstacle to the proposed route. At this time, so many gold-seekers were trespassing in the Black Hills that the government notified the Indians they must turn themselves over to the agencies by January 31, 1876 or be considered hostiles. This action eventually led to the famous Yellowstone campaign and Custer's demise. The first official trip by the Cheyenne and Black Hills Stage, Mail and Express line left Cheyenne on February 3, 1876, using the Red Cloud Agency route. The distance of 246 miles to Custer City via the Red Cloud Agency took 2 to 3 days (depending on the season) and cost a first-class passenger 20 dollars. The completion of the northern division out of Fort Laramie cut the distance to about 178 miles.

Within in the ROI in present Laramie and Platte counties, several stage stations and road ranches were established along the route that left Cheyenne via Camp Carlin and Fort D.A. Russell. Along the southern part of the system, these way-stations included:

- Nine-Mile Ranch;
- Pole Creek Ranch, or Schwartz' two-story hotel (18 miles north of Cheyenne);
- Horse Creek or Fagan's Ranch (second scheduled stop, 28 miles north of Cheyenne);
- Bard's Road Ranch on Little Bear Creek (unofficial stop, 3 miles north of Fagan's; regular station after May 1877 called Little Bear);
- Bear Springs Road Ranch or Armijo's;
- Chugwater Ranch (stage station kept by H.B. Kelly);
- Chimney Rock (the John McFarlene and Dan McUlvan ranch);
- Bordeaux (Hunton's ranch, official relay station in June 1876);
- Chug Springs (4 miles northeast of Bordeaux);
- Eagle's Nest Station (near Eagle's Nest Rock, an emigrant-signature rock);
- Six Mile Ranch (relay station, 6 miles south of Fort Laramie);
- Three Mile Station (meal station); and
- Fort Laramie (headquarters in Rustic Hotel).

Several additional stops were dispersed along that part of the route running north of Fort Laramie. These included:

- Ten Mile Station;
- Government Farm (14 miles north of Fort Laramie);

- o Rawhide Buttes (on Rawhide Creek at foot of Rawhide Buttes);
- o Silver Springs Ranch; and
- o Raw Hide Springs (camping place for freighters).

Eleven years after its inception, the route was discontinued. The last stage from the Black Hills pulled into Cheyenne on February 19, 1887.

2.6.4.1.5 The Indian-Military Frontier

2.6.4.1.5.1 Land Cessions and Confrontation

Before the fur trappers searched the streams for beaver and the emigrant wagons passed through the region, the Arapaho, Cheyenne, Sioux, and other tribal groups occupied this region.

The Fort Laramie Treaty Council of 1851 designated the area between the South Platte and Arkansas rivers in Colorado as the hunting lands of the Cheyenne and Arapaho. The Sioux agreed to hunt north of the North Platte River. All tribes agreed to leave the emigrant roads unmolested and to allow the establishment of military posts and roads in their territories (Ubbelohde et al. 1972:102; Larson 1978:14-15). In Colorado, the Pikes Peak gold rush encroached upon Arapaho and Cheyenne lands, necessitating a second treaty in 1860, which created a small, triangular-shaped reservation between the Arkansas River and Sand Creek. The situation was less than ideal; isolated raids inflamed white settlers in Colorado and resulted in Chivington's massacre of Black Kettle's Cheyenne at Sand Creek on November 29, 1864. This served to fuel the flame of Indian resentment and in turn resulted in the sacking of Julesburg in January 1865. By the Treaty of Medicine Lodge Creek in 1867, the Cheyenne and Arapaho tribes were moved to Indian Territory, and eastern Colorado was "cleared" of all Indians, although two more engagements were fought in that area: Beecher's Island in 1868 and Summit Springs in 1869 (Ubbelohde et al. 1972:108-109).

To the north, the continued use of the Oregon Trail by large numbers of emigrants greatly increased the chances of conflict. A pattern of "incidents" developed between Euramericans and Indians, followed by retaliatory acts. An incident that resulted in the Grattan Massacre developed from a dispute over an emigrant's cow near Fort Laramie. When the impetuous Lt Grattan was sent into a large Brule Sioux village, 30 soldiers were killed along with Chief Conquering Bear. The military responded with the Harney Campaign in 1856 and its indiscriminate attack on a camp of Brule Sioux on the Blue River near Ash Hollow, Nebraska (Larson 1978:16-17).

The last stronghold of the Plains Indians gradually dwindled to the Powder River country north of the North Platte River and east of the Big Horn Mountains, and included the Black Hills. The Connor Expedition was launched into this sanctuary in 1865 in yet another retaliation for Indian depredations along the Oregon and Overland trails. With 2,500 men divided into three main columns, Connor hoped to surround and crush the Indians. The plan was sound in theory, but the reality was a colossal failure. The main damage to the Indian forces occurred at the Battle of Tongue River, where an Arapaho village was destroyed by Connor at the present site of Ranchester, Wyoming. The other two columns accomplished little, suffering exposure and starvation, and were barely able to reach Fort Connor (Larson 1978:23-24).

In 1866 the Bozeman Trail (an emigrant road to the Montana goldfields laid out by John Bozeman through the Powder River country in 1863) was strengthened by building a system of forts that included Fort Phil Kearny and C.F. Smith. Another peace treaty was negotiated at Fort Laramie in June 1866, eliciting a promise from the Sioux to leave the Bozeman Trail through the Powder River country unbothered, even as Col Carrington was en route to create the system of forts mentioned above. Chief Red Cloud, however, made no such promise and carried on his famous war on the Powder River that resulted in the Fetterman Massacre near Fort Kearny and the deaths of 81 soldiers in December 1866. This Indian victory and the constant raids that effectively closed the Bozeman Trail led to the Fort Laramie Treaty of 1868. Conceding the region to the Indians, the government abandoned its forts and forbade white travel through the area (Kappler 1904:774-775). This treaty must rank as one of the greatest Indian triumphs in the history of the western Indian wars, a victory that was short-lived. The Black Hills gold rush in 1874 and the new hostilities culminated in the Battle of the Rosebud, the Custer Massacre, and other campaigns that led to the treaty of September 26, 1876. The treaty was signed by a small minority of Indians at the Sioux agencies, even though the 1868 treaty did not allow further land cessions unless three-fourths of the adult males signed (Larson 1978:106). By 1877 the ROI had been cleared of its indigenous population and was ready for permanent Euramerican settlement. Larson (1978) gives a concise history of the complicated subject of the Plains Indian wars in this region.

2.6.4.1.5.2 Military Installations and Camps

A number of military installations and camps were created to protect the emigrant telegraph and mail routes. Along the Oregon Trail, Fort Laramie became a military post in 1849 and served that function until its abandonment in 1890. Fort Mitchell was built near Scotts Bluff in 1864 and abandoned in 1867, when Indian troubles in that area subsided. On the Lodgepole Trail, Camp Walbach was established on August 20, 1858, near Lodgepole Creek (east of Cheyenne Pass and approximately 20 miles northwest of Cheyenne) to protect emigrants using the trail. It was officially abandoned on April 19, 1859, and in 1916 a state monument was erected near the site. In 1866 Fort Sanders (originally Fort John Buford) was constructed on the Laramie Plains near present-day Laramie by Captain Henry R. Mizner. It was located on the Laramie River near the Overland Stage route and the Lodgepole Trail and provided protection for both (Homsher 1949:13-14). Farther south, Camp Collins (named for Lt Col W.O. Collins) was established in the fall of 1863 by Company B of the First Colorado Volunteers. Log cabins and stables were constructed a short distance upstream from LaPorte, Colorado. The camp was built to protect the Overland Trail as well as the few settlers in the area. It was later occupied by two companies of the 11th Ohio Volunteers from Fort Laramie. The camp was moved to the site of the present city of Fort Collins in 1864 and abandoned in the spring of 1867 (Watrous 1911:211-226).

In addition to the several military posts noted above, two were established during the same general period near what is now Cheyenne, Wyoming: Fort D.A. Russell and Camp Carlin. The former has been in continuous operation for over 100 years. Much of the following discussion of the history of these two facilities is adapted from Adams (1974).

The history of Fort D.A. Russell is linked inseparably with that of the first transcontinental railroad. In 1862 the Railroad Act provided federal subsidies for construction of a cross-country line and prescribed the location

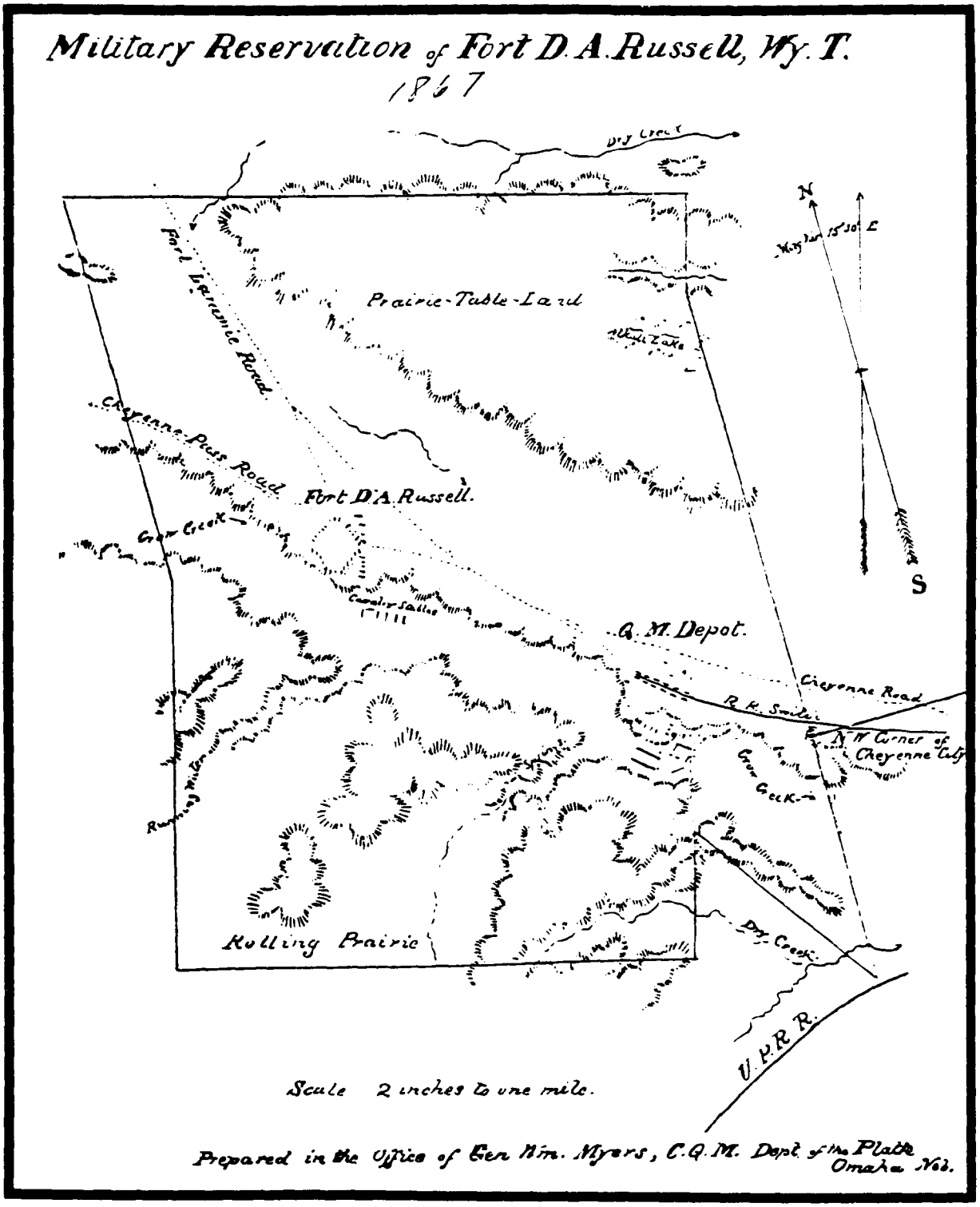
of a division point at the eastern base of the Rocky Mountains. Track laid beyond that point was to earn greater federal assistance for the builder. Because the government had a vital interest in the construction and successful operation of the line, the Army was charged with protecting railroad work gangs and property against hostile Indians. Accordingly, on July 4, 1867, when Gen Grenville M. Dodge, chief engineer for Union Pacific, designated Cheyenne as that company's mountain region headquarters, Gen Christopher C. Augur established Fort D.A. Russell about 3 miles to the west (Figure 2.6.4-3). Named in honor of an Eighth Infantry officer killed during the Civil War, the post adjoined Crow Creek and rested strategically halfway between the Canadian and Mexican borders and only a few hundred miles closer to Los Angeles than to New York.

Detachments of the 30th Infantry and Second Cavalry formed the first garrison at the new fort. For a brief time, the troops lived in log huts and tents, but during the winter of 1867 to 1868, both officers and enlisted men moved into frame quarters. These were arranged in the shape of a diamond, which opened to the east and had axes measuring 800 and 1,040 feet. To supply Fort D.A. Russell and other military installations in the vicinity, the Army erected Cheyenne Depot immediately southeast of the new post. Known popularly as Camp Carlin (sic) in honor of its founder Col Elias B. Carling, the depot eventually grew into one of the largest supply bases in the West and came to employ an average of 285 civilians.

Until completion of the railroad in 1869, troops from Fort D.A. Russell and other area posts guarded every surveying party and construction gang. After the railroad was built, the Indians left it alone, but they continued to harass travelers and emigrants and thus kept the soldiers busy performing escort duty and tracking stolen livestock. In 1868 the federal government and the Sioux signed a treaty that created a large reservation in Dakota Territory and set aside lands north of the North Platte River and east of the Big Horn Mountain as a hunting reserve for the Indians; however, this did not bring peace. Under terms of the document, the Army had to abandon three forts in the hunting region, and no white person could enter it. The area became a haven from which the Sioux could raid passersby and settlers in the thinly populated country between the Union Pacific Railroad and the North Platte. As a result of these conditions, Fort D.A. Russell soldiers carried out numerous scouting expeditions in present-day Wyoming, Colorado, Kansas, and Nebraska.

During the late 1870s, post units participated in major campaigns against both the Sioux and the Ute. For years, Euramericans increasingly were becoming interested in prospecting for gold in the Black Hills, but that region lay within the large Sioux reservation created in 1868. Recognizing that Euramericans could not be kept out of that area, the United States tried to persuade the Indians to sell it. They refused, and in 1875 the government decided to force all Sioux hunting bands onto the reservation and thereby end their raiding activities and diminish their ability to resist Euramerican penetration into the Black Hills. Ultimately, this policy led to the ill-fated Sioux campaign of 1876 and the Battle of Little Big Horn. During this operation and the actions that immediately preceded and followed it, cavalry and infantry from Fort D.A. Russell formed part of Gen George Crook's command.

Three years later trouble occurred with the Ute, and Capt J. Scott Payne and a Fifth Cavalry detachment from Fort D.A. Russell figured prominently in that conflict. Difficulties began when Indian Agent Nathan C. Meeker tried to force the Ute, who occupied a reservation in western Colorado, to abandon



SOURCE: WYOMING STATE ARCHIVES, MUSEUM AND HISTORICAL DEPARTMENT, 1983

MILITARY RESERVATION OF FORT D.A. RUSSELL (1867)

FIGURE NO. 2.6.4-3

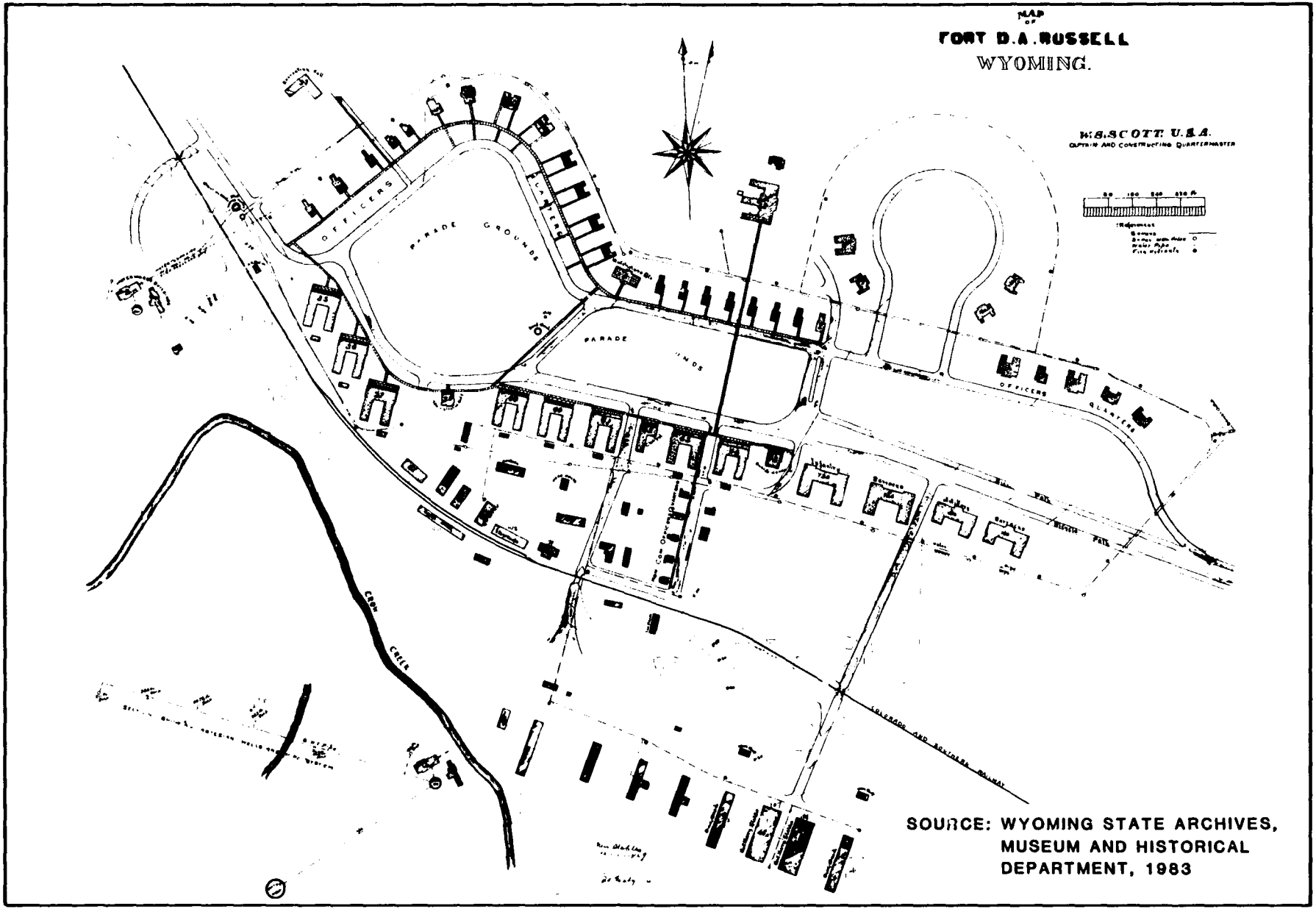
their hunting customs and become farmers. Because white Coloradans were clamoring for the tribe's removal to Indian Territory, Meeker's demands forced the Utes to the brink of revolt. Alarmed, the agent requested military assistance to restrain the Indians, and in September, Maj Thomas T. Thornburgh of the Fourth Infantry gathered a command of about 155 men, including Payne's detachment, and proceeded to the vicinity of White River Agency on the Ute Reservation. There, unsuccessful efforts to arrange talks precipitated a full-scale battle and a series of depredations that left Thornburgh, Meeker, 10 soldiers, 9 agency employees, and at least 23 Indians dead. Having assumed command upon Thornburgh's death, Payne requested reinforcements, and Col Wesley Merritt brought them quickly from Fort D.A. Russell. News of these events alarmed the entire nation and resulted in the assembling of hundreds of troops in western Colorado, but fortunately Ute leaders and Indian Bureau officials achieved a peaceful settlement of the crisis.

During the 1880s, the Army abandoned many of its older Indian-fighting posts. Fort D.A. Russell was retained, however, because it was located strategically along the transcontinental rail route. In 1885 the War Department ordered the post rebuilt to serve eight infantry companies. In place of the old frame structures the Army put up 27 red brick buildings. These included barracks (Buildings No. 207, 212, 213, 214, 215, and 216) and both noncommissioned (Buildings 274 and 275) and officers' quarters (Buildings 1, 2, 22, and 24). A similarly constructed hospital (Building 31) reached completion in 1887 and an administrative building (Building 210) in 1894. The creation of these brick structures helped establish a U.S. military construction pattern that continued until the beginning of World War II.

Unfortunately, none of the new barracks at Fort D.A. Russell was spacious enough to house a full company comfortably, and for several years morale remained low. Moreover, in 1890, the War Department dismantled Cheyenne Depot and thus removed additional luster from the larger parent installation. The fort could boast, however, of having the Army's most thoroughly drilled mule pack train. From the Fort, cadres traveled to other military stations to activate similar units.

In 1898 the Spanish-American War brought renewed importance to the post. Soon after President William McKinley sent a war message to Congress in April, the Eighth Infantry departed from Fort D.A. Russell to Cuba. Later, the Wyoming National Guard was mustered into service at the post and readied for duty in the Philippines. When the war ended, the United States found itself in possession of island territories and therefore constrained to continue maintaining an alert armed force. Thus, in 1901, the Army underwent reorganization, and in 1905, Secretary of War William H. Taft recommended that Fort D.A. Russell be made a brigade-size post. A major expansion program resulted in the construction of a large number of red brick quarters, offices, and stables between 1902 and 1910 (Figure 2.6.4-4). During that same period, various post units served as part of the American occupation and pacification forces in both Cuba and the Philippines. From 1913 to 1916 other post outfits performed patrol duty along the United States-Mexican border, and during World War I, the fort served as a mobilization point and training facility for field artillery and cavalry groups.

With the end of the war in Europe, another Army reorganization occurred. Fort D.A. Russell underwent few changes. During the 1920s, however, it housed cavalry and artillery units almost exclusively, along with hundreds of the Army's finest horses and mules. During this period of peace, post personnel



PLAN OF FORT D. A. RUSSELL (1905)

FIGURE NO. 2.6.4-4

devoted much of their time to beautifying the fort and to either playing or watching polo. The installation had two polo practice fields, a polo exhibition field, and a 28,000 sq ft indoor riding arena (Building 314).

The next decade brought a new name for the post. On January 1, 1930, it became Fort Francis E. Warren in honor of Wyoming's senior U.S. Senator who had died a short time earlier after 37 years in office. Few other changes occurred at the fort during the 1930s, but the coming of World War II produced a myriad of them. Between December 1940 and December 1941, the Army erected 387 new buildings on the post reservation and turned it into a quartermaster training center for more than 20,000 men. In 1942 an officer candidate school was established at the fort and in 1943 a prisoner-of-war camp. Some of the prisoners died there and are buried in the post cemetery.

Two years after the war ended, the Army relinquished Fort Francis E. Warren to the Air Force, and the post became Francis E. Warren Air Force Base. Initially, the Air Force used the base as a training facility for its aviation engineer, administration and supply, and fixed wire communications schools, but in 1958 the Strategic Air Command (SAC) assumed control of the base. The technical schools moved away, and the following year SAC organized the nation's first solely tactical intercontinental ballistic missile wing at the base and deployed Atlas missiles there. In 1963 the 90th Strategic Missile Wing took charge of the installation and deployed 200 Minuteman missiles in underground launch sites within a 150-mile radius of Cheyenne. This operation remains the primary mission at the base.

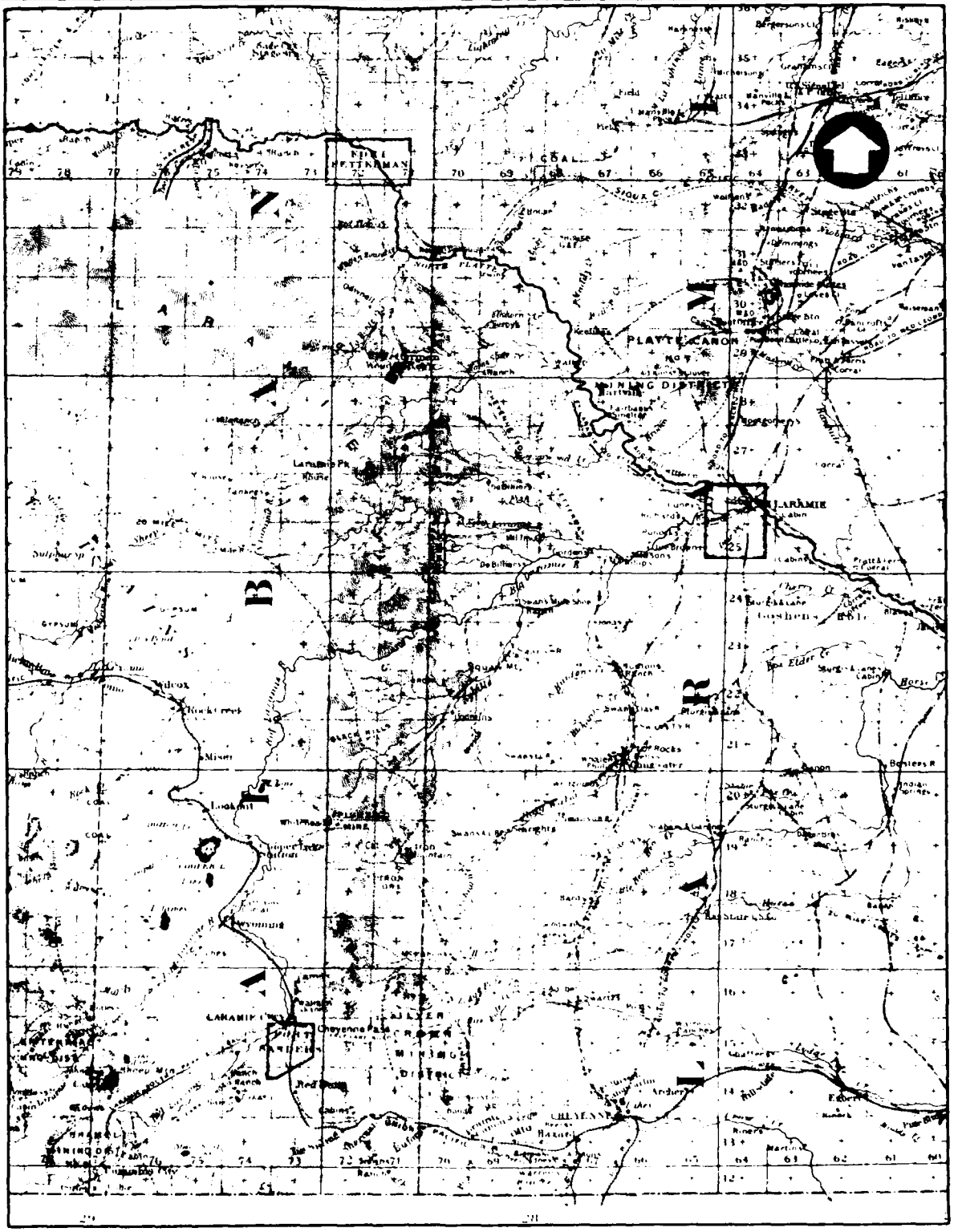
In 1969 the F.E. Warren Historic District was listed in the NRHP, and in 1974 much of the base also was designated as a National Historic Landmark.

2.6.4.1.6 The Mining Frontier

Hard-rock mining for precious minerals has played an important, albeit indirect, role in the history of the ROI. The premier gold and silver mining districts were located in Colorado from Boulder and Gilpin counties southward. Once crossing the southern boundary of Larimer County (moving north) along the Rocky Mountain chain, deposits drop quickly in importance. The major effect of the mining frontier on the ROI was the influx of miners bound for the mining country to the southwest, starting in 1859. This influx affected the transportation systems and brought the first permanent settlers. Farming and ranching in the South Platte Valley developed in part to support the mining communities, and grubstakes for entering other businesses were made in the mines (McKinley 1938:46) (Figure 2.6.4-5).

Denver quickly grew as a result of its proximity to the mines and became a thriving commercial center. As a result, the Denver Pacific built southward from the Union Pacific tracks at Cheyenne in 1869. Tracklayers began at Cheyenne on September 15, 1869 and reached the Colorado border on October 4 and Evans on December 13 that same year; the line was opened for business at that time. The following spring, the line was completed to Denver. The Denver Pacific became the Union Pacific in 1880 and spurred growth all along its right-of-way in the Front Range (Wilkins 1974:3).

During the initial prospecting phase, hopeful miners scoured the foothills and mountains of western Larimer County. There was a short-lived flurry of activity at Lulu City (1879-84) near the crest of the Divide between Milner and Cameron passes in today's Rocky Mountain National Park. In 1877 a silver



A PORTION OF HOLT'S NEW MAP OF WYOMING(1883)

FIGURE NO. 2.6.4-5

rush to North Park on the west side of the Divide (outside the ROI) led to the establishment of Teller City, which reached a peak population of 1,200. The silver deposits quickly played out, and distance from markets and inadequate transportation turned Teller City into a ghost town almost overnight (Eberhart 1974:108-111).

The mining camp of Manhattan was established in Poudre Canyon in 1886, about 4 miles northwest of present-day Rustic, Colorado. Gold was discovered there during a systematic search organized by Fort Collins businessmen. The inevitable rush ensued, and a concentrating works was built to treat the ore in 1888. Nevertheless, the deposits did not justify the effort, and the camp was finally abandoned. Summing up the mineral resources of Larimer County in 1911, Watrous states: "Almost every foot of the mountain region from the Southern to the Northern boundaries of the county and from the foothills to the summit of the Medicine Bow Range has been prospected, but not a single profit-producing mine has ever been opened and worked" (Watrous 1911:153).

Coal deposits in the northern part of the county were used for a short time by the town of Cheyenne (1868 to 1869), but the fields developed to the south in Weld and Boulder counties were far superior in quantity and quality and little commercial development of the northern deposits occurred.

The presence of precious metals in the Medicine Bow Mountains (Albany County, Wyoming) had been suspected quite early. Several accounts state that Captain Douglas, a member of Sir George Gore's hunting expedition, found gold in the Medicine Bow Mountains in 1856 and that Douglas Creek was named for him. F.V. Hayden of the U.S. Geological Survey stated that "valuable specimens of ores and placer gold" were brought to him from the mountains southeast of Fort Steele (Beeler 1906:11).

The first well-documented discovery of gold in the Medicine Bows occurred in the fall of 1868 when Iram Moore found gold on a tributary of Douglas Creek. Significant amounts of placer gold were taken in the Douglas Creek District, an area about 15 miles long and 10 miles wide. Several lode mines were located. These included the Douglas Mine (1870), Florence Mine, the New Rambler, and the Keystone, which had an estimated total production of $96,000 (Osterwald et al. 1966:66). The latter was opened for gold but also produced significant amounts of copper after 1900 (Hess 1926:134-145).

The Centennial Ridge District was developed in 1876 after initial discoveries of gold deposits in stream gravels on Centennial Ridge. Several lode mines opened, including the Centennial (the chief producer of the District, which had a 10-stamp mill and aerial tramway to the base of the mountain), the Utopia Mine, the Free Gold. Only these mines had any documented ore production. Most of the mines suffered from sheer veins, where the ore deposit was suddenly lost and could no longer be followed (Wiegand 1976:4; Hausel 1980:31-38).

After 1900 the District experienced new excitement when platinum and palladium were extracted from copper ores in the New Rambler Mine. This precipitated new mining activity in the region and several new claims (e.g., the Empire No. 1, the Cliff Mine, and the Queen Mine). The U.S. Geological Survey visited the District in 1924 and found that "the chances for significant discoveries are too few to warrant the expenditures of money, time and labor" (Hess 1926:135). In 1931 a short-lived townsite called "Platinum City" was promoted by A.J. Hull, who sold thousands of shares of stock to out-of-staters and finally was indicted for mail fraud (Laramie Leader, April 8, 1931).

The Silver Crown Mining District was located 20 miles west of Cheyenne in Laramie County in the eastern foothills of the Laramie Range. It was organized on April 4, 1879, with the greatest amount of development occurring on the Comstock and Copper King lodes from 1881 to 1910. Values were principally in copper, silver, and gold. A small community known as Hecla developed from this activity. A concentrating plant and small smelter were built to process the ore, but the supply of ore was not sufficient to warrant such expenditures. Remnants of the smelter can still be found near Hecla (Klein 1974:1-3).

The Laramie Peak Mining District lay in the extreme northern portion of Albany County. Although the region has experienced prospecting for mineral deposits throughout recent history, none of the efforts were particularly profitable. According to Arthur C. Spencer:

> Evidences of prospecting, assigned by local tradition to the period immediately following the discovery of gold in the Cherry Creek and Pikes Peak districts in Colorado, are to be noted from place to place within the area....Stories of gold having been won by individuals and of lost mines are current, but no printed records are known to justify the belief that there has ever been any production worthy of mention (Spencer 1916:56).

General prospecting began around 1875 and continued with concentration on copper ores after 1900. A pocket of gold ore was discovered in the 1890s near Warbonnet Peak, which caused increased but short-lived activity near the head of LaPrele and LaBonte Creeks (Spencer 1916:56-57). The following mining districts were developed: Spring Hill or North Laramie Peak District; Warbonnet District; Deer Creek District, which included the Esterbrook Mine; the Three Cripples; the Maggie Murphy; the Pyramid; the Copper King; and the Oriole Mines.

Rich deposits of copper and iron have been mined in the Hartville Uplift in northeast Platte County, one of the most profitable mining districts in the ROI. The first claim was known as the Green Mountain Boy and was filed on May 20, 1881 by N.T. Miller. The Sunrise copper claim was established on October 10, 1881. This claim was finally transferred to the Wyoming Copper Company. The town of Hartville was established near the mining operations. The Wyoming Copper Company, which had the backing of such Chicago notables as George M. Pullman, established a smelter 1.5 miles above the present town of Guernsey. A short-lived town known as Fairbank grew up near the smelter. The smelter was moved in 1888 to the Sunrise Mine, leaving Fairbank a ghost town. All claims were sold to the Colorado Fuel and Iron Company of Pueblo, Colorado in 1900, and emphasis changed to iron ore. A spur line was built to the Colorado and Southern Railroad and intensive development of the Sunrise for iron ore began. By 1916 the company was glory-holing the mines with an underground caving system, resulting in a open pit 650 feet deep that produced a million tons of ore by 1942. Production gradually declined, although it operated continuously until 1980. A company town, also known as Sunrise, grew up near the iron operations about 1 mile east of Hartville (Wyoming Historical Records Survey Program 1939:16-17; Platte County Extension Homemakers Council 1981:24-25, 28-29).

Mining in the mountainous portions of the ROI was never highly productive compared to the great mining camps elsewhere in the Rocky Mountain West. Many

of the so-called rushes were based on wishful thinking, irresponsible distortion of the facts by the media, and promotional schemes. The search for precious minerals and base metals in the ROI, however, did lead to extensive exploration and development of the region. Settlements sprang up overnight, capital was injected into the economy, roads were constructed, jobs created, and in a few cases, railroads were built. The people experiencing a gold rush had no way of knowing at the outset that their camp might not become another Leadville or Virginia City (Thybony et al. 1982).

2.6.4.1.7 The Era of the Cattleman

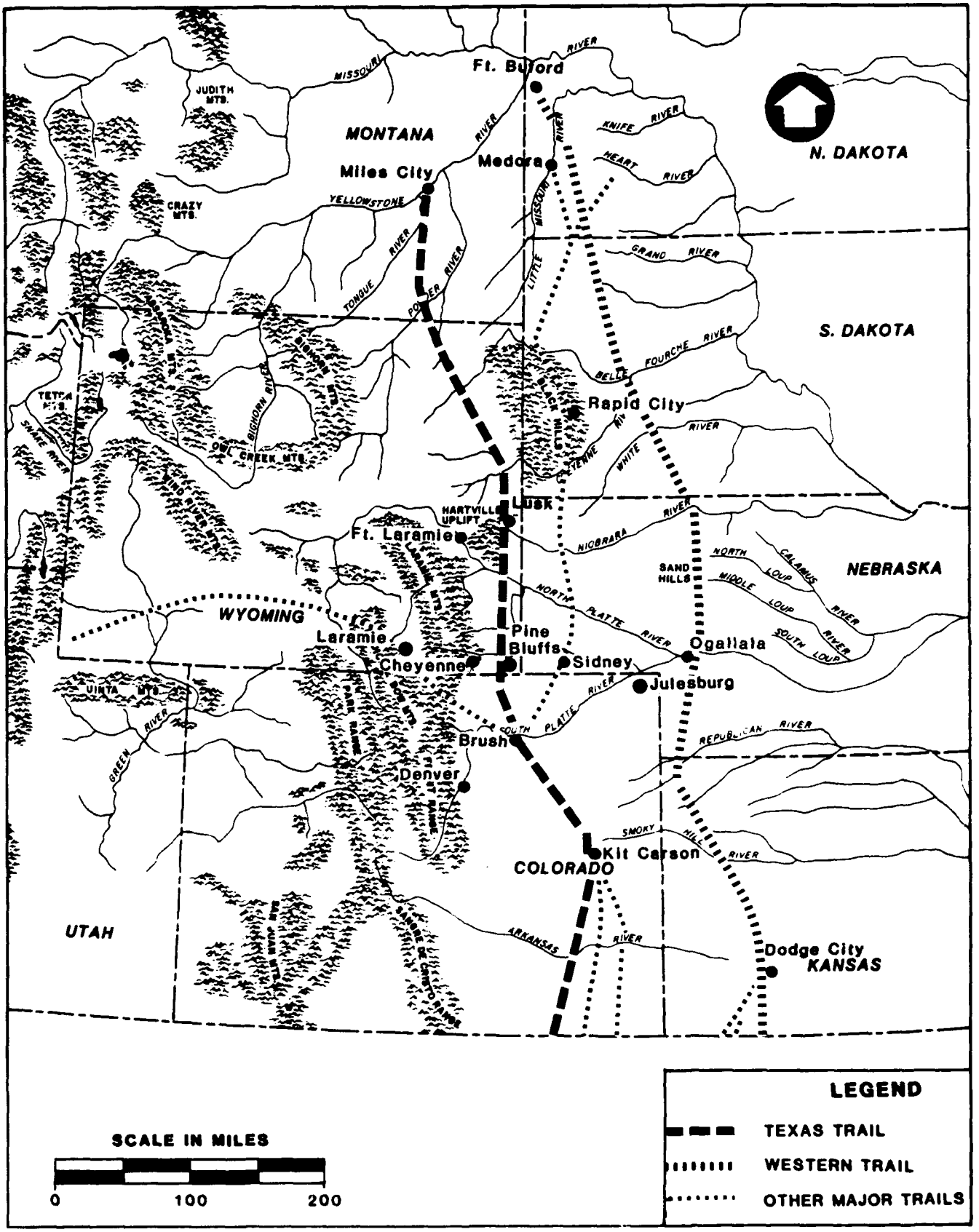
2.6.4.1.7.1 Origins

Stories abound concerning the origins of the range cattle industry on the western Great Plains. Prospectors and freighters involved in the 1859 Pikes Peak gold rush observed that oxen abandoned or lost on the prairie thrived on the buffalo and grama grasses and could survive the blizzards on the same range. As one historian observed: "Why men who had seen buffalo survive on those same grasses should have been surprised to discover that domesticated cattle could live on them is something of a mystery" (Ubbelohde et al. 1972:163-164). Alex Majors credits Seth Ward, sutler at Fort Laramie, with handling the first wintering-over of cattle in about 1852 (WPA 1940, 1941; Dick 1975:269-270).

Small herds of cattle were raised on road ranches along the major emigrant trails in the ROI, but it remained for the great Texas trail drives to stimulate the cattle industry. Two major factors were involved: the surplus of cattle in Texas that could no longer be sold to southern markets because of the Civil War, and the building of the Union Pacific Railroad through the ROI in 1867 and 1868 (Spring 1942:17-18; Krakel 1954:167).

The Texas cattle industry was based on the Texas longhorn, a Mexican breed that traced its bloodlines to Spain. These herds had spread to Texas after 1750. During the Civil War, the traditional markets for beef had been closed by northern troops, and the cattle had multiplied on the Texas range (Peake 1939:268). With the close of the Civil War, enterprising individuals reasoned that the railroads pushing across the Great Plains would provide access to eastern beef markets, where the prices had been inflated by war. It remained to find out if herds could be successfully driven north, and the first large-scale drives began in earnest. Farther north, Nelson Story had driven a herd from Texas to the Montana goldfields in 1866 via the Bozeman Trail. In 1868 John W. Iliff brought a herd of Texas longhorns to the vicinity of the new town of Cheyenne to sell to butchers and to ship eastward (Spring 1942:17-18).

The major impetus for the creation of the range cattle industry in the ROI was the building of the Union Pacific Railroad in 1867 to 1868. Lured by the railroad and the surrounding grasslands, W.G. Bullock and B.B. Mills brought the first permanent herd into Wyoming from Kansas, Iowa, and Missouri. The operation was set up near Fort Laramie but was moved southward to Bordeaux because of Indian raids. Their "SO" brand passed to J.M. Carey and Brother (Spring 1942:18). In Nebraska, Ogallala became the chief trail town for herds using the Western Trail extension from Dodge City, Kansas (Mahnken 1947:94) (Figure 2.6.4-6). The trail also continued north through western South and North Dakota to Fort Buford on the upper Missouri River. This trail was probably used to supply the various Indian agencies as well as to stock the



THE GREAT CATTLE TRAILS

FIGURE 2.6.4-6

range. Another major trail passed through Sidney, Nebraska (also on the Union Pacific mainline) that came from Brush, Colorado, a major point on the trails north. A second branch of this trail left Brush and headed into Wyoming. This was known as the Texas Trail in Wyoming and passed through Pine Bluffs, Fort Laramie, and Lusk to stock the Powder River country after 1876. The best crossing for livestock along the South Platte led to Cheyenne or along the Overland or Cherokee Trail along the South Platte and Cache La Poudre to the Laramie Plains (Spring 1942:45-46; Krakel 1954:170; Olson 1955:194-195; Dick 1975:269-273).

In addition to the Texas herds, cattle were driven from Oregon via the Lander Cutoff and Oregon Trail into eastern Wyoming and Colorado. By 1879 there were an estimated 100,000 head of cattle from Oregon in the two territories (Spring 1942:46).

2.6.4.1.7.2 Open Range Days

The open range cattle industry that developed in the ROI was based on the Spanish tradition passed on through the Texans. The open range method of ranching was well-suited to the expanses of the region. Cattle were allowed to graze over unfenced areas year round, relying on the sparse but nutritious prairie grasses that cured on the stem in the dry climate. Winter winds usually cleared large areas so that the cattle could reach forage (U.S. Congress 1884:578).

Under an open range system, a rancher needed a headquarters with available water, where he would construct more permanent buildings after the sale of one or two herds. The Spanish system of branding was necessary to identify cattle after a winter of drifting with the storms. Spring round-up would gather the cattle in a particular geographical region, where they would be sorted and new calves branded (U.S. Congress 1884:578-581). There was an inevitable mortality factor of 3 to 4 percent in open range grazing.

Cattlemen soon realized the need for organization in order to regulate the industry. The Laramie County Stockgrowers Association was created on November 30, 1873. Open range ranching presented a number of problems, such as regulating brands for owner identification, organizing round-ups, controlling disease, freight rates, and rustling, as well as the potential for political strength. By 1879 the organization had changed its name to the Wyoming Stockgrowers Association and it soon invited similar groups from Colorado, Nebraska, and Montana to join. The Colorado Stockgrowers Association had been formed much earlier (1867). By 1871 it had reorganized into an efficient lobbying group that pushed through legislation favorable to its interests, such as a round-up district law that completely regulated the spring round-ups (Ubbelohde et al. 1972:166-167). In Nebraska the cattlemen tended to organize on a county-by-county basis (e.g., the Western Nebraska Stockgrowers Association). Their concerns included the registering of brands and organization of round-up districts, until western Nebraska was taken into the Wyoming Stockgrowers Association (Dick 1975:277). They used their political influence both on the local and state level to control the open range and keep the "nesters," or homesteaders, at bay. The homesteaders, however, gradually encroached from east to west, using the herd law adopted in 1871 that forced cattle ranchers to confine their herds from indiscriminate wandering over the public domain. This law could be suspended locally by county officials, but once homesteaders gained the majority in any given county, the herd law usually went into effect (Olson 1955:199). In Wyoming the Stockgrowers

Association grew in numbers and power. Membership was carefully controlled by an admissions committee that investigated prospective members. Three negative votes from this committee meant that the applicant was refused admission. A blacklist, which carried the names of cowboys that members were forbidden to employ, also was drawn up by the same committee (Larson 1978:171).

Round-up districts were enlisted in Wyoming, Nebraska, and Colorado and functioned in the same way. Each state or territory was divided into round-up districts. Committees were appointed to organize round-up parties, each of which had a foreman. Parties met at an appointed time and place and rounded up cattle for the particular district. After each owner's cows had been cut out, remaining strays and mavericks were sold at market and the proceeds placed in Association coffers if the owner could not be found or did not claim his cattle by the next annual meeting (U.S. Congress 1884:579-580).

Prominent figures in Colorado included John W. Iliff, the Brush Brothers (Orchard Co., along Big and Little Crow creeks), Bruce F. Johnson (between Johnson and Loveland), the Wyatt Brothers (Ault), and Asa Sterling. In Wyoming, Iliff again figures prominently, along with Alexander Swan, J.M. Carey, Charles Hutton, Edward Creighton, Thomas Sturgis, Francis E. Warren, and W.C. Irvine. In western Nebraska pioneer cattle ranchers often were former contractors for the railroad and telegraph companies, who had intimate knowledge of the region and had invested their construction profits in cattle. The Lonergan Brothers trailed Texas cattle into the Ogalalla area. Edward Creighton, builder of the telegraph line, settled nearby. The Coad Brothers took possession of the old stage station at Scottsbluff (just west of Melbeta) in 1870 and soon had 10,000 head of cattle grazing from Courthouse Rock to the Mitchell Valley along the North Platte River. John A. Creighton, credited as being the first rancher in the Panhandle, ran cattle on Pumpkin Creek in 1867. In 1877 the Powers brothers ran cattle on the north side of the river from the Coad operation. One of the largest outfits in the Panhandle was the Bay State Land and Cattle Company, organized with Boston and Omaha financing in 1882. It soon absorbed the Circle Arrow (owned by Creighton, Snodgrass, and McShane) and the Coad Ranch. Other notable pioneer ranchers include Coe, Carter, and Bratt (Union Pacific tie contractors), the Keystone Cattle Company, and Frank and Luther North.

John W. Iliff provides an excellent example of the nineteenth century cattle baron. He initially made some money in the 1859 Colorado gold rush selling a wagon train of provisions and used the proceeds to buy a small herd of cattle. He moved the herd to his headquarters near present-day Iliff, Colorado, on the South Platte River. He then brought in a large herd of Texas cattle in 1867 to 1868 purchased from Col Goodnight. Owning 15,000 to 20,000 acres, he was able to control about 650,000 additional acres stretching from Greeley to Julesburg. His home range was triangular in shape with Julesburg to the east, Greeley on the southwest, and Cheyenne on the northwest. He supplied beef to the Union Pacific Railroad, military installations, and Indian agencies, and shipped beef and hides East. Iliff died in 1878, and his second wife Elizabeth often was referred to as the "Cattle Queen" after that time (Krakel 1954:191-193; Ubbelohde et al. 1972:166-167).

Foreign capital was injected into the cattle industry, chiefly from England and Scotland. By 1878 to 1880, 80 to 90 percent of England's imported beef came from the United States (ocean vessels could then refrigerate the meat), and it was only natural that investors became interested. Analysts from England and Scotland, sent to study the American cattle industry, realized

that once the quality of cattle was improved, the western rancher with free land at his or her disposal might eventually put British stock growers out of business. The fastest way to make money at that time was to invest in American beef, a phenomenon that took England by storm. A large enterprise such as the Swan Land and Cattle Company was capitalized at $3 million and ran 123,460 head of cattle (Frink et al. 1956:135-159; Larson 1978:168). In Colorado the Prairie Cattle Company was organized in 1881 with headquarters in Denver. There were three divisions: the northern one extended from a large part of Weld County south to New Mexico, and the other divisions included parts of Texas, New Mexico, and Oklahoma. The northern division alone was composed of 2,400,000 acres, where 53,982 head of cattle were grazed (Krakel 1954:179). An estimated $45,000,000 was invested by foreign interests in the American cattle business in the 1880s.

The cattle barons managed to secure large land holdings in a number of ways. Since about 40 acres of land was required per head in this semiarid region and, as John Wesley Powell stated, at least 2,560 acres were needed for a successful ranch, the prospective rancher had to circumvent the existing land laws. The larger outfits were able to purchase the alternate Union Pacific Railroad sections outright, but these lands were soon taken. Two quasi-legal principles were established to control the range: 1) priority right, or "first come, first served", and 2) accustomed range, which is the custom of not driving off stock from their usual grazing grounds. Violation of these principles met with fines in Nebraska and with the wrath of the rancher concerned elsewhere (Dick 1975:273-274).

The Report of the Governor of Wyoming for 1883 (U.S. Congress 1884:584) contains a fascinating discussion of the cattle industry. Governor Hoyt explained how to use the existing land laws to obtain sufficient land for an operation and he also anticipated the need for fencing and winter hay long before the tragic blizzard of 1886 to 1887:

> A married couple, the wife being able to enter 640 acres under the Desert Land Act, can get possession of 1,760 acres, sufficient to support several hundred cattle. If, say, three men having means sufficient to make the payments at the land office necessary when filing upon land, under the four acts referred to, join their entries along a stream of water, they will have grazing land enough for at least a thousand head of cattle. They will be put to the expense of erecting fences around their lands and sheds to protect their herd against violent storms, but that done, their business will, it is thought, be put upon as safe a basis as is cattle-raising in Iowa.

The prospective cattleman often was forced to resort to fraudulent methods to obtain and hold sufficient acreage. "Dummy filings" were not uncommon (e.g., cowboys filing on land that their employers desired). Good bottomlands and meadows were filed upon under the Desert Land Act, because overburdened land office employees were often unfamiliar with the lands they were dispensing. The possibilities were numerous and fraud was almost impossible to prevent or unravel. A rancher who controlled the water sources in arid country controlled all surrounding lands by default. Thus Iliff's holdings that stretched all along the South Platte River guaranteed him all interior land, which was useless without river access. Thomas Sturgis of the Union Cattle

Company gained control of a strip of land 55 miles in length along Rawhide Creek in Wyoming by filing 55 fraudulent Desert Land claims, using nonresidents living in New York, New Jersey, and Massachusetts. He satisfied the irrigation requirement by plowing one continuous furrow along its length (Pelzer 1936:189).

2.6.4.1.7.3 Years of Decline

Tremendous profits were to be made in the cattle business, especially in the early 1880s, and the number of outfits running cattle grew rapidly. The flooding of the market caused a steady decline in prices after 1884, however, and much of the range became overstocked. Drought conditions in the summer of 1886, followed by the devastating blizzard of that winter, depressed the cattle business for many years and forced a number of cattlemen out of business. Revitalization of the industry was a long, slow process after 1886 to 1887.

Although Wyoming's cattle losses as a consequence of the winter of 1886 and 1887 were less than Montana's or the Dakotas', they were still estimated at about 15 percent, and figures as high as 85 percent are reported. In Colorado one rancher recalled riding from Julesburg to Cheyenne, seeing dead cattle the entire way. Another rancher, E.M. Prouty, rode along Pumpkin Creek (Nebraska) and observed: "...never have I seen so many dead animals! Carcasses formed a veritable blanket over that entire territory between the creek and bluffs to the north. One could have walked miles on the creek bed over frozen bodies" (Dick 1975:284). The Sandhills of Nebraska fared better than the rest of the state, and the surviving herds served as the nucleus for the revival of the cattle industry in the 1890s. The poor condition of the cattle that survived, however, decreased their market value considerably. Furthermore, the calf crop the following spring was significantly reduced. The biggest losers were the large cattle companies that operated totally under the open range system and had depended on sheer numbers and plentiful free grazing land. With no winter hay put aside and no shelter or water provided, such operations suffered severely. English investors lost $10 million and Scottish investors $7 to 8 million. The blizzard of 1886 to 1887 eliminated competition in what had become a crowded field and effectively ended the open range system of the cattle industry (Krakel 1954:187-188; Olson 1955:198; Larson 1978:190-192).

2.6.4.1.7.4 Sheep Ranching

Large portions of the ROI were well-suited to pastoral forms of agriculture, specifically cattle and sheep raising, because low land prices and free grass and water cut costs almost in half. The initial outlay for sheep ranching, however, was estimated at one-third the cost of cattle ranching (Wentworth 1948:308-309). Many of the sheep were brought into the area from the west, where the industry was already well established. Consequently, the era of the great sheep trail drives, beginning around 1865, reversed the westward tide of migration as breeding sheep were driven east from California. From Red Bluff in the north and Bakersfield in the south, trails led through Reno, Nevada, and northern Nevada to Salt Lake City or Soda Springs, Idaho, to Rock Springs and the Red Desert of Wyoming. From 1885 to 1901 trail drives continued, shifting to Oregon and the northwest. These sheep usually were wethers raised mainly for meat (Wentworth 1948:258-259). Sheep could fetch twice the price in Wyoming towns that they could in Oregon (Evans 1951:77-78).

In the southern part of Colorado Territory, the sheepmen had preceded the cattlemen because of the tradition of raising sheep on Mexican land grants. It was not until 1869, however, that Merino sheep were introduced into Weld County by Captain Maynard. He grazed his flocks (obtained in Canada and Illinois) along Lone Tree Creek south of Cheyenne and in the vicinity of present-day Nunn, Colorado. The flocks were shipped into Cheyenne via the Union Pacific and grazed on Maynard's Meadow Springs Ranch, which is still in opertion south of Cheyenne. Thomas Weldon raised sheep in the valley of the Big Thompson, and E.W. Whitcomb located on Box Elder Creek at about the same time. In 1871 William H. Batchelder established a sheep ranching operation near Camp Collins (near LaPorte, Colorado) in Spring Canyon and imported purebred Merinos from Vermont (Krakel 1954:185).

In the ROI portion of Wyoming, buffalograss, bunch grass, and native bluegrass provided excellent sheep forage, and the rolling plains were well-watered. The 1870 Census showed 6,409 sheep in the Territory, mostly in Albany County. The Laramie Plains were considered the best sheep range in the Territory. The first sheep were introduced there by George Creighton and Charles Hutton in 1870. In 1871 John and Thomas Durbin began raising and breeding sheep 4 miles from Cheyenne, buying 500 sheep held for slaughter by Amos Peacock for his butcher shops. They were the first to export sheep from Wyoming in 1872, via the Union Pacific. Other pioneer sheep ranchers included Judge W.L. Kuykendall on Crow Creek, M.E. Post, and James A. Moore. The latter were considered the "sheep kings" around Cheyenne in the mid-1870s. On the Laramie Plains, despite periodic heavy losses from winter storms and droughts, the sheepmen had become dominant over the cattlemen without bloodshed by 1872. Too many operators and over-fencing of the range gradually pushed the sheep industry westward from the Laramie Plains and southeast Wyoming in general, except for the largest operators, who held railroad land and large patented blocks containing well-watered hay meadows. One such ranch was the Warren Livestock Company founded by Francis E. Warren. Warren started in the sheep business in 1871 as Converse and Warren, and also ran cattle. In 1878 Warren bought out Converse and went into partnership with W.B. Miner of Fort Collins, Colorado. This lasted for 5 years. In 1883 the Warren Livestock Company was incorporated. By 1889 it controlled 248,000 acres with 38 ranches and sheep stations on both sides of the Union Pacific tracks. By 1891 the company was running 110,000 sheep and 2,500 Angora goats (Wentworth 1948:312-314).

The decline of the cattle industry throughout the ROI after the blizzard of 1886 to 1887 allowed the sheep industry to expand. It nearly dominated the cattle industry in the late 1890s and early 1900s with an all-time high of 7 million sheep raised in 1910. Much like cattle, sheep were allowed to overgraze the fragile range and suffered heavy losses in years of drought (Vass and Pearson 1927:14; Ankeny 1956:1).

The sheep and cattle wars of the 1890s and early 1900s were the inevitable result of the early dominance of the cattle industry and the phenomenal growth of the sheep industry. Cattlemen felt that sheep cropped the range grasses too close and contaminated the range, rendering it unfit for cattle. Personality differences between the cowboy and the sheepherder contributed to the range wars. The cowboy regarded himself as a virile, two-fisted, rough-and-ready adventurer, while the solitary sheepherder with his wagon and dogs seemed to lead a dreary existence devoid of action. Conflicts followed a basic pattern: cattlemen prohibiting sheepherders from crossing arbitrary lines that they inevitably had to cross to reach summer and winter ranges.

Violence ensued; mass clubbing, poisoning, dynamiting, and driving sheep over cliffs occurred; wagons were burned; and herders were badly beaten and sometimes murdered (Wentworth 1948:524). The ROI, however, was spared most of the violence experienced on the western slope of Colorado and the Bighorn Basin of Wyoming. Confrontation continued well into the twentieth century, only gradually subsiding as grazing restrictions on the public domain became more stringent, better organized, and more highly regulated.

Although sheep ranching in Nebraska was a much smaller industry than in the Rocky Mountain states, a sheep-feeding industry was initiated by Dr. George, who began feeding New Mexican sheep at Gibbon in 1877 or 1878. Other farmers in the Platte Valley followed, and the sheep-feeding business made Nebraska one of the leading sheep exporting states between 1880 and 1900. Most sheep were driven from Oregon to Wyoming, loaded on the Union Pacific at Laramie, and then shipped to the Platte Valley for fattening, usually on corn that they had to be taught to eat. The peak year for this industry was 1897 (Dick 1975:292-293).

Sheep ranching throughout the ROI has experienced a steady decrease in profits in the twentieth century due to grazing fees, increased government regulations, predators (control of which by poisons was restricted in 1972), and lack of manpower. Nevertheless, both Wyoming and Colorado still derive a significant share of their agricultural income from sheep ranching. With the recent increase in demand for natural wool, the industry may experience a revitalization.

From an historical perspective, the sheep industry was a major factor in the settlement and economic development of Wyoming and Colorado. It helped both states overcome the economic devastation wrought on the cattle industry by the blizzards of 1886-87, and nearly dominated the livestock industry from the 1890s to the outbreak of World War I. Finally, the introduction of French and Spanish Basque herders to the industry enriched the ethnic and cultural base of both Wyoming and Colorado.

2.6.4.1.8 The Homesteader's Frontier

2.6.4.1.8.1 Federal Land Policy

The history of the homesteader's frontier in the second half of the nineteenth century is predicated on federal land policy and its underlying philosophy. Therefore, a brief examination of the homestead laws is necessary to an understanding of the pattern of land settlement in the ROI. (Portions of the following discussion are abstracted from Lau and Rosenberg 1982:83-88.)

In 1841 the Preemption Act was passed, entitling a citizen of the United States to "squat" on public land. When that land was finally surveyed and put up for sale, the squatter was granted first chance to purchase up to 160 acres at $1.25 per acre. Formerly, settlers had been technically trespassing if they dwelt on the land prior to purchase (Robbins 1942:89-90; Larson 1965:173). The Preemption Act established a new government policy toward land that would be embodied in the Homestead Act of 1862 and subsequent land legislation that affected settlement in the ROI. It established the principle that settlement of public domain was more important than revenue. It also established the precedent of breaking up public lands into small homesteads, thereby benefitting the largest number of people while reducing the hold of land speculators and those already holding sufficient land (Robbins 1942:91).

The Homestead Act of 1862 went one step further and allowed a citizen of the United States, who had reached the age of 21 or was the head of a family, to file on as many as 160 acres of "unappropriated public lands." Restrictions required that the entrant maintain residence for 5 years and swear that he intended to cultivate and settle the land himself. A filing fee of $34 on the Pacific Coast and $26 elsewhere represented the only cash outlay. With 6 months' residence and the improvement of 1 acre or more of land, the homesteader could gain title by purchasing the land at $1.25 per acre (commutation). After 1872 Civil War Veterans could apply months of service to the residency requirement (Sheldon 1936:25-26; Robbins 1942:206-207; Larson 1978:172-175). In Nebraska a great deal of land was filed on between 1854 and 1862 using Mexican War land bounties.

With the passage of the Homestead Act of 1862, the "principle of free lands" was established by the federal government. "Henceforth, the desire to have the public lands pass into private ownership as rapidly as possible dominated our land policy. Rapid disposal insured early settlement and development, then considered most desireable" (Gates 1935:16-17). Private ownership, it was reasoned, resulted in the protection and improvement of the land. As farms were established and crops planted, the value of the land would increase. The public domain, on the other hand, was subject to spoliation by squatters, large timber companies, and mining and railroad interests. Unfortunately, federal land policy had originally been formulated for lands east of the Mississippi with a less harsh environment and higher rainfall. As aptly stated by Gates:

> Framers of our national land system have too often thought of the United States as a homogeneous geographic unit in which there is little variety in climate, rainfall, and adaptability to plant production. To them the farm unit of 160 acres, which is well suited to certain sections east of the Mississippi, should likewise be sufficient for farming in the semiarid regions of the high plains and the greater interior basin (Gates 1935:19).

As homesteaders in what John Wesley Powell referred to as the "Arid Region of the United States" began to take up 160-acre homesteads and experience the difficulty of making a living on such a small parcel, the federal government attempted to adapt the laws with piecemeal legislation often more unrealistic than the Homestead law itself. The Timber Culture Act of 1873 allowed an individual to claim 160 acres if he agreed to plant 40 acres in trees and keep them growing for 8 years. Five years later the acreage was reduced to 10 acres. Nevertheless, settlers soon learned that it was virtually impossible to grow trees in such a climate (see T.A. Larson 1978:174, for the case of Joseph M. Carey). One of the field inspectors for the General Land Office stated in 1885: "I have travelled over hundreds of miles of land in western Kansas, Nebraska, and central Dakota, nearly one-fourth of which had been taken under the 'Timber Culture Act,' without seeing an artificial grove or even in incipience, and can scarcely recall an instance in any one day's travel where the ground had been more than scratched with the plow for the purpose of planting trees" (Olson 1955:168).

The Desert Land Act of 1877 attempted to fashion a land policy more suited to the western environment. A homesteader could buy up to 640 acres of "desert land" (land which required irrigation for the cultivation of crops). He could

pay 25 cents per acre for the first 3 years, after which $1 per acre was paid to gain title. In the interim the settler had to irrigate at least a portion of the land to patent it (U.S. Statutes at Large 1875-1877:377). Once again this act proved untenable in most areas lacking year-round water sources for irrigation. As a result only 4,148 patents were issued from 15,898 filings under the Desert Land Act in Wyoming Territory (Larson 1978:175).

2.6.4.1.8.2 Initial Settlement

Settlers were first attracted to Colorado Territory (the southern portion of the ROI) by the Pikes Peak gold rush of 1859. Agriculture developed as disgruntled miners turned to growing crops for mining communities. People of Spanish descent had been farming successfully using irrigation methods in southern Colorado Territory prior to the gold rush, but the Euramerican miner of northern Colorado had to learn his own irrigation and farming techniques due to language and distance barriers. The well-watered South Platte Valley was adjacent to the mining region, and small farms that could be irrigated easily spread out along the river. The first successful irrigated farm among the Fifty-niners is credited to David K. Wall, who farmed 2 acres near present-day Golden (Hafen 1948:121-125; Ubbelohde et al. 1972:186-187).

Except for these small farming operations and the presence of road ranches, stage stations, and military installations along the emigrant roads, very little settlement had taken place before the advent of the railroad. Homestead settlement in the ROI was retarded by a number of factors, even after the Union Pacific was constructed in 1867. The railroad provided the needed impetus for the cattle industry and commercial interests in the railroad towns, as well as for businesses and jobs connected with the railroad, such as the railroad tie industry and mining. Nevertheless, the success of the settlement system based on the small farming homestead, as envisioned by the federal government, was adversely affected by several factors. First, the cattle rancher had turned the somewhat hostile environment to his advantage in large-scale pastoral pursuits. Cattle ranching ultimately proved to be the best use for most of the land in the "Arid Region," as Powell had predicted in 1878. Cattle interests required large amounts of open land to sustain a profitable operation. By controlling the available water, they prevented the small homesteader from making inroads into their vast cattle kingdoms. After the advent of cheap barbed wire in 1875, the homesteader theoretically could afford to fence his parcel, but the cattle rancher in turn fenced the public domain, which he did not own but merely claimed through custom. In many cases, he could totally surround a homestead with fence, preventing ingress or egress. Secondly, the small homesteader/farmer had chosen either to head for the fertile valleys of Oregon or California, or to cling to the eastern fringes of the Great Plains, areas less arid than the ROI. Therefore, until the regions to the west and east were saturated, farmers had little incentive to brave the harsh climate, the cattle ranchers, or the Indians. Finally, the Union Pacific Railroad was not as generous with its lands as it would be in later years. The alternate sections granted to the railroad for a distance of 20 miles on each side of its tracks were intended to be sold by the railroad to help pay its debts to the federal government. Instead, the land was usually leased to large cattle interests and that money used for debt payments. The railroad failed to patent many of its lands in Colorado until the 1890s to avoid paying taxes. These conditions favored the cattle rancher over the small homesteader/farmer. The odd-numbered sections could be purchased by homesteaders for $2.50 per acre; however, preemption land cost only $1.25 per

acre, and homestead land cost only the filing fee. Also, railroad land was limited to 80 acres to homesteaders (Sheldon 1936:98).

With some or all of these drawbacks facing prospective settlers, it is little wonder that homestead settlement developed so slowly in the ROI. By the 1880s, however, conditions began to change. First, an act of Congress (February 25, 1885) forbade the fencing of the public domain by cattlemen. Even such cattle barons as Alexander Swan and John Hunton were forced to remove their extensive fencelines. Secondly, William A.J. Sparks was appointed Commissioner of the General Land Office and proceeded to crack down on fencing and land fraud violations, and consequently stirred up the Eastern press against the cattlemen. The blizzard of 1886-87 broke the back of the cattle barons, and the weakening of that industry proved an opening for the homesteader. Furthermore, an increase in the rainfall in the arid region in the 1880s made farming appear more attractive. Finally, the growth of agricultural experiments and colonies in the ROI provided the homesteaders a means to combat cattlemen with an organized force, rather than as isolated individuals.

2.6.4.1.8.3 Agricultural Colonies

Agricultural colonies began in Colorado in the 1870s. They followed a basic pattern of initial organization, usually originating in the large cities of the East or Midwest and purchasing land blocks from a railway company or subsidiary land company. There were varying degrees of cooperation and leadership among the colonists. Most ventures were communal agricultural efforts based on irrigation. The railroads were eager to promote such schemes to help settle the land through which their lines passed, increasing their profits as a result. Perhaps the most noteworthy example was the Union Colony (Greeley), organized by Nathan Meeker, agricultural editor of the New York Times, who was already experienced in agricultural colonies. His idea was endorsed by Horace Greeley and memberships were offered at $155 to "temperant individuals." This money was used to purchase the site. Locating near the confluence of the Cache La Poudre and South Platte rivers, members purchased a 12,000-acre plot from the Denver Pacific Railroad (the feeder line built from Cheyenne to connect Denver with the Union Pacific in 1869-1870), with provisional title to 60,000 additional acres. Colonists began arriving in the spring of 1870, establishing a town named after Horace Greeley. The colony was an overnight success and used extensive irrigation systems to produce astonishing crops. A fence built around the colony at a cost of $20,000 prevented neighboring cattle from trampling crops, proving that a cooperative effort could successfully combat the cattle interests.

Other colonies followed in the area, hoping for Greeley's success. Evans had been the temporary terminus of the Denver Pacific in 1869. In 1871 the St. Louis-Western Company organized an agricultural colony under the Reverend Andrew Todd. While not as successful as the Union Colony, it was not a "dry" town, providing a temptation and an attraction for prospective colonists. Platteville also was started along the Denver Pacific mainline. It was organized by the Platteville Land Company, which sold land to settlers along the South Platte and St. Vrain rivers. The land was not purchased cooperatively nor was cooperative labor used in building irrigation systems. Fort Collins in Larimer County was established by the Fort Collins Agricultural Colony, organized by General Robert A. Cameron, a leader in the nearby Union Colony. It was built in 1872 upon the abandoned Fort Collins Military Reservation. A town ditch was built in 1873 and an irrigation canal followed the next year. Although Fort Collins grew slowly, the Colorado

Central Railroad built north in 1876, and the Colorado Agricultural College was located there in the early 1870s (although it did not open until 1879) under the Morrill Act, and despite Greeley's protestations. The Chicago-Colorado Colony, organized in 1870, founded Longmont the following year on Middle St. Vrain Creek on Denver Pacific lands. It became a very successful colony with the benefit of good management as well as financial aid from Elizabeth Thompson of New York (Watrous 1911:211-265; Krakel 1954:221-223; Ubbelohde et al. 1972:128-129).

At Salem, 40 miles northeast of Cheyenne, Swedish farmers from Iowa conducted successful dry-farming operations in the late 1870s (Larson 1978:360). Wheatland developed as a result of an irrigation project by the Wyoming Development Company, organized in 1883 by such notables as Joseph M. Carey, William C. Irvine, John W. Hoyt, and Francis E. Warren. Using the waters of the Laramie River, and Sybille and Chugwater creeks, as well as reservoirs in Albany County, the company eventually brought 60,000 acres under cultivation. It was not a true colony in the sense of a cooperative, but consisted of individual irrigated farms. Town construction did not actually begin until 1893. A sugar beet industry also developed there which culminated in the building of a Great Western sugar refinery in 1930 (Wyoming Historical Records Survey Program 1939:18-19).

2.6.4.1.8.4 The Second Homesteading Phase: Moving onto the Plains

Success in early farming was dependent on the presence of sufficient water for irrigation. Farmers clung to the North and South Platte River valleys or close to the Front Range of the Rockies, where mountain tributaries were available. Such factors as the invention of windmills, James Oliver's chilled plow that could handle prairie sod, and hardy red winter wheat from the Crimea, encouraged farmers to take up the vacant, unwatered lands of the Plains. The final catalyst was a cycle of heavy rainfall in the 1880s that fooled people into believing that some fundamental shift in climate was taking place and resulted in the belief that "rain follows the plow." Irrigation projects, diversion of mountain water onto the plains, and the tilling of the soil allowed the dry prairies to soak up the rain. The wind sweeping over this moistened soil created a more humid atmosphere, which in turn promoted more rainfall. The belief that the more the prairie was plowed, the moister the climate became, was popular at the time (Olson 1955:174). With the continued encouragement of the railroads and their associated land companies, homesteaders began pouring onto the Plains in the 1880s in an initial assault that lasted as long as the unusual wet weather pattern. Dry years in 1889 and 1890 provided the warning. The year 1894 brought the worst drought to the ROI until the 1930s. With the additional factor of the financial panic of 1893, abandoned homesteads dotted the prairies of eastern Colorado, eastern Wyoming, and western Nebraska.

2.6.4.1.8.5 Irrigation

As stated earlier, small-scale irrigation had been practiced by farmers in the South Platte Valley and in several of the agricultural colonies. Large corporations were formed in the late 1870s for construction of water systems to turn a large profit for investors. The Larimer and Weld Canal (1879) and the North Poudre Canal (1881 to 1884) were built by the Colorado Mortgage and Investment Company and the Travelers Insurance Company. Large reservoirs were built in the South Platte Valley in the 1880s, as were transmountain water

diversion systems, beginning with the Cameron Pass Ditch in 1882 (Hafen 1948:121-125).

These activities presaged similar ventures in the remainder of the ROI, including the Wheatland colony previously described. Although the North and South Platte rivers crossed the region, large-scale reclamation projects were beyond the scope of private or state enterprise. The federal government became involved with the passage of the Carey Act in 1894. Written by Wyoming Senator Joseph M. Carey, it allowed the federal government to donate up to 1 million acres of arid lands to each state possessing such areas, on the condition that the states reclaimed and settled the acreage. Wyoming accepted the offer (the first state to do so), charging settlers 50 cents an acre. A private construction company in turn charged the settler $20 per acre for perpetual water rights. Several projects were started in the Bighorn Basin, and the Wheatland enterprise soon became a Carey Act project. The cost burden was borne either by the state or by private individuals and companies (Larson 1978:303-304). The Newlands Act of 1902 created a reclamation fund established from the sale of western lands and provided loans to individuals undertaking small-scale reclamation projects.

The North Platte project resulted in Pathfinder Dam, completed in 1910, utilizing two canals on either side of the North Platte: the South Side or Fort Laramie Canal and the Interstate Canal on the north side (10 miles below Guernsey Reservoir, which acts as a regulatory facility) (McKinley 1938:96-97). The results of this gigantic reclamation project were directly felt by Goshen County. By 1915 the canals were completed, and over 1 million acres of land in the county were under irrigation by 1940, providing crops of sugar beets, seed potatoes, alfalfa, and wheat. Torrington, the county seat, had a post office by 1889 and became an incorporated town in 1908. The building of the Burlington Railroad through town, a Union Pacific spur from south Torrington to Yoder (1926), and the North Platte Valley Cut-off to Cheyenne (1928) all assured the community's success as an agricultural center (Wyoming Historical Records Survey Program 1940; WPA n.d.).

In Scotts Bluff County, Nebraska, over 150,000 acres of land were reclaimed, making it the state's most heavily irrigated county. Prior to the large irrigation projects, its population was 1,188 in 1890 and 2,552 in 1900. By 1930 it was the fourth most populated county in the state. By 1940 it was first in density of rural farm population. According to Olson: "By 1940 the city of Scottsbluff, which in 1900 had been only a little huddle of tar-paper shacks, ranked sixth in the state." The town was organized in about 1899 by the Lincoln Land Company, and developers anticipated that Gering, the county seat, would move to the new site across the river. Due to animosities, most Gering businessmen did not relocate, and the two communities exist side-by-side today (Olson 1955:328). As a direct result of irrigation and land reclamation, Scotts Bluff County has successfully produced such diverse commodities as sugar beets, potatoes, beans, canning crops, alfalfa, corn, barley, and oats.

2.6.4.1.8.6 Dry Land Farming

The next agricultural phase was known as dry land farming. Coupled with increased immigration to the United States and the increasing scarcity of good cheap farming land, homesteaders turned to submarginal lands with these new techniques. As mentioned earlier, dry farming had been tried at Salem in the late 1870s with some success. The Campbell system of farming, developed by

Hardy W. Campbell, had been used in Nebraska and Kansas. His theory was based on storing and conserving the natural rainfall by compressing the subsoil and keeping the topsoil loose by cultivation; it also entailed leaving parcels fallow and keeping the surface free of moisture-robbing vegetation (Union Pacific Railroad 1909:1417; Dick 1975:356-357). The theory of dry farming is sound, and it is still practiced today in the ROI. Nevertheless, a basic minimum amount of rainfall is necessary; below that amount, dry farming is not possible. Wyoming, Nebraska, and Colorado all encouraged dry land settlement of their semiarid lands through Boards of Immigration and State Boards of Agriculture. The railroads, of course, participated in this advertising campaign and often provided free transportation to homesteaders.

At the same time that the dry farming craze began, the amount of land available to homesteaders began to increase. In the Nebraska Panhandle despite the increasing popularity of dry farming, "millions of acres...had been passed over by settlers who thought it not worth taking as a gift from the government" (Dick 1975:374). The land was better suited to stock raising, but settlers could not legally obtain enough land for successful ranching or dry farming. According to Dick, 100 cattle on 1,000 acres were needed to support 1 family. Congressman Moses P. Kincaid of Nebraska introduced a bill to enlarge homesteads to 1,280 acres. It became law on June 28, 1904, although by that time homesteads had been cut to 640 acres. It applied to only 37 counties in Nebraska west of the 98th Meridian and excluded all irrigable land. In 1909 the Commissioner of the General Land Office inspected the Kincaid area and was surprised at its success; most settlers combined stock-raising with dry land farming to achieve their economic stability. When Congress debated the Stock-raising Act of 1916, the example of the Kincaiders helped its passage (Dick 1975:374-377).

Dry land farming was also practiced in parts of Wyoming. Despite droughts in 1910 and 1911, dry land farmers experienced good years in 1912 and 1913. In 1914 Laramie County was the foremost dry farming county in Wyoming, with 512,612 acres (generally southeast of Cheyenne) under cultivation in what is known as the Golden Prairie District, where oats, wheat, barley, rye, and potatoes were grown (Larson 1978:363). This was a direct result of such land promoters as J.R. Carpenter, C.L. Beatty, and M.E. Cotton, the latter an employee of the Union Pacific Railroad. It is not insignificant that the inception and growth of towns in this region corresponded with the railroad lines through this portion of Wyoming (i.e., the Union Pacific branch line from Egbert to Torrington).

2.6.4.1.8.7 The Great Depression: The End of the Homesteading Era

The Stock Growing Homestead Act led to a flurry of land entries well into the 1920s. With high agricultural prices, farmers used their profits to purchase more land, equipment, and seed. Many of the new land entries reflect not new homesteads but rather existing ones acquiring more land. During World War I, cultivated acreage in the Nebraska Panhandle doubled. Kimball County and parts of Banner County developed into specialized wheat producing areas (Olson 1955:280). Unfortunately, agricultural prices began plummeting after 1920, and farmers preceded the rest of the nation into the Depression by using up their wartime profits on acquiring additional land instead of paying off their mortgages (Olson 1955:296). The Great Depression, coupled with drought years in 1930, 1931, 1934, 1936, and 1939, destroyed the dry farmer and many homesteads were abandoned. Some settlers persevered but, no longer able to

make a living from the land, became dependent on relief. Tax delinquency was therefore commonplace, and county governments had difficulty maintaining roads and administering the school systems.

The Resettlement Administration, created by Executive Order on April 30, 1935, began purchasing homesteads that were abandoned or operating at a loss on marginal lands. These lands were to be returned to their original status as grazing lands. Some of the residents on purchased lands were resettled on better lands, upon which they might become self sufficient. These consisted of separate farms scattered throughout existing farm districts or settlements, one of which existed near Lingle.

In 1934 the Taylor Grazing Act and two subsequent Executive Orders were passed that withdrew the remaining public domain from entry, thus virtually ending the homesteading era (except on certain reclamation projects). Its intent was "to stop injury to the public grazing lands by preventing overgrazing and soil deterioration, to provide for their orderly use, improvement, and development, to stabilize the livestock industry dependent upon the public range" (U.S. Statutes at Large 1934). The federal government had finally realized that the ROI was not viable for large-scale or small subsistence farming. Instead it was much better pastoral land, profitable if properly administered and regulated with a small number of larger operations. Forage crops and some cash crops are grown today in the ROI (i.e., the large sugar beet industry in the North and South Platte valleys of Colorado and Nebraska), but these areas are limited to irrigable lands along the principal year-round watercourses and hardy forage crops.

2.6.4.2 Summary of Known Resources

Cultural resource inventories maintained by the Wyoming, Nebraska, and Colorado SHPOs list over 1,100 historic Euramerican sites within the ROI (Table 2.6.4-1). Sixty-eight of these are listed in the NRHP and an additional 136 have been determined to be eligible for listing in the NRHP. Seven sites have been declared to be not eligible.

Various types of properties, consisting mainly of structures but also including pioneer burials, battlefields, trading posts, and the like, have been researched by regional or local societies or by concerned citizens and have been formally recognized by municipal, county, or state governmental agencies as having historic value. In some instances, the research conducted for these resources has not been sufficiently rigorous or detailed to permit determination of NRHP eligibility. It is expected, however, that a favorable determination may be obtained for many of these properties once the process is initiated, particulary for those properties recorded in communities such as Torrington, Wyoming, and Kimball, Bushnell, Dix, and Scottsbluff-Gering, Nebraska. Although other properties may never satisfy NRHP eligibility criteria, they could continue to have historic value for a particular area or segment of the population within the ROI.

Known historic Euramerican resources within the ROI represent several themes pertinent to the history of the area, including mining (e.g., Gold Dust Mine in Albany County, Rawhide Buttes Mining Area in Laramie County, Chicago Mine in Platte County) and transportation (e.g., the Overland, Oregon, and Mormon trails, Denver to Fort Laramie Road). Evidence of early Euramerican exploration and settlement of the region appears as campsites, rock signatures, and graves found along historic trails and as numerous abandoned

Table 2.6.4-1

RECORDED HISTORIC SITES IN THE REGION OF INFLUENCE

	Location	Number of Sites	Status[1]				Examples of Known Sites
			R	E	D	N	
Wyoming	Albany Co.	213	11	27	-	8	Overland Trail; Natural Fort; Gold Dust Mine; Lodge Pole Creek Trail
	Goshen Co.	137	5	12	-	6	Cheyenne-Ft. Laramie Rd.; Oregon Trail; Rawhide Buttes Mining Area; Mormon Trail
	Laramie Co.	260	21	9	1	1	Denver-Ft. Laramie Rd.; Lodge Pole Creek Tr; Bay State Cattle Co.; Texas Trail; Cheyenne; F.E. Warren Historic District/Landmark
	Platte Co.	87	1	23	-	-	Oregon Trail; Chicago Mine; Mormon Mail Station
Nebraska	Banner Co.	47	-	-	-	-	Historic house
	Kimball Co.	36	-	-	-	-	
	Scotts Bluff Co.	39	1	-	-	-	Fort Mitchell; Horse Creek Treaty Grounds; Robidoux Trading Post; Brown site
Colorado	Larimer Co.	156	23	9	-	2	Larimer & Weld Canal; Overland Tr.; Colorado and Southern RR Depot; Rocky Mountain Nat'l Park Historic District
	Weld Co.	176	6	56	6	-	Larimer & Weld Canal; Ft. Vasquez; Overland, Dodge, Cherokee Trails; Greeley

Note: 1 R = On Register; E = Eligible; D = In District; N = Not Eligible.

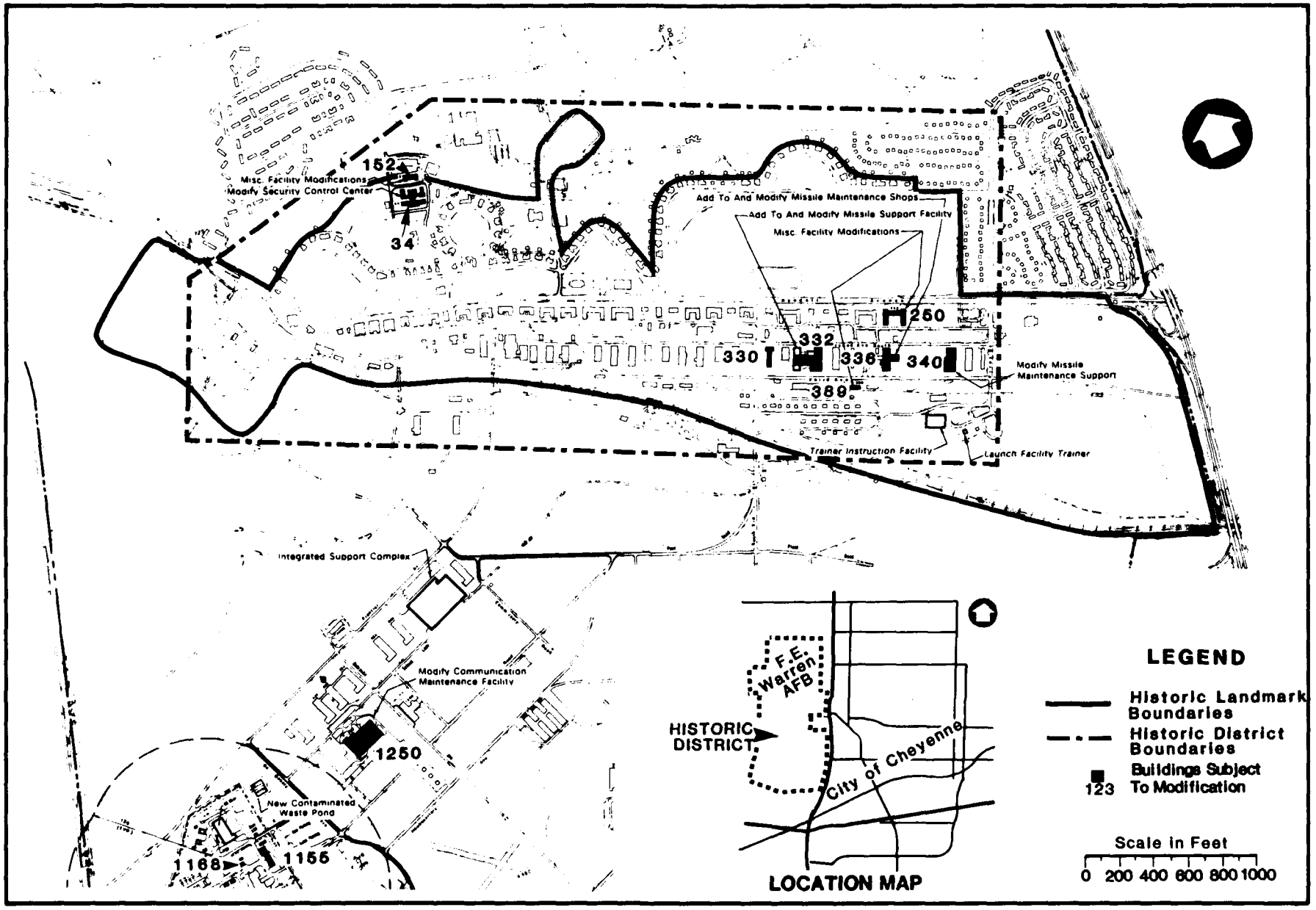
Source: Wyoming, Nebraska, and Colorado State Historic Preservation Offices.

homesteads and farmstead sites. The railroad era is represented by abandoned railroad beds and trestles and by standing structures such as the Colorado and Southern Railroad Depot in Larimer County and the Union Pacific Railroad Depot in Cheyenne. Other developments in the history of the ROI are represented by the Horse Creek Treaty Grounds in Scotts Bluff County, the Bay State Cattle Company in Laramie County, and the Larimer and Weld Canal.

Many of the recorded resources are those with architectural qualities that are unique, representative of a particular period or style, or are otherwise noteworthy. Cities such as Cheyenne, Greeley, and Fort Collins have designated Historic Districts (e.g., Cheyenne's Downtown Historic District, Greeley's Fifth Street Neighborhood Area, Fort Collins' Old Town) containing structures dating to the late Victorian era or evidencing other stylistic features. F.E. Warren AFB contains a large Historic District consisting of nearly 100 NRHP-listed structures that date to the late nineteenth and early twentieth centuries (Figure 2.6.4-7).

Individual structures or smaller groups of buildings within the ROI also have been recognized as possessing architectural importance. These include theatres (e.g., Park Theatre, Estes Park); railroad depots (e.g., Union Pacific Depot, Cheyenne; Loveland Depot, Loveland); schools (e.g., Whitecrest School, Laramie County; Lincoln School, Greeley); commercial buildings (e.g., Holly Sugar Factory, Torrington; 3M Fire Company, Kimball; Grier Furniture Company, Cheyenne); hotels (e.g., Wheat Growers Hotel, Kimball); government facilities (Fort Collins Post Office; Erie Town Hall, Erie, Colorado; Torrington Courthouse); homesteads (Touns Homestead, Laramie County; Walgreen and Rutten Homestead, Goshen County; Cash Lewis Homestead, Albany County; Enos Mills Homestead Cabin, Estes Park, Colorado); agricultural structures (Rock Ranch, Goshen County; Stemmlor Ranch Barn, Goshen County; Coad Ranch, Laramie County); and churches (Epworth Church, Banner County; Saint Joseph's Church, Laramie County; Saint Matts Cathedral, Albany County). In numerous cases, as noted for the buildings in the F.E. Warren AFB Historic District, the structures recognized as architecturally important also have historic value or have been associated with important persons or events.

Evidence of Protohistoric and early Historic American Indian activity and occupation is widely, though sparsely distributed throughout the ROI and adjacent areas. A review of the Nebraska, Wyoming, and Colorado site inventory files indicates that only 15 known sites are assignable to the Protohistoric or early Historic periods; six are in Wyoming and nine are located in Colorado (Figure 2.6.4-8). Morris et al. (1979) describe five Larimer County sites dating from AD 1650-1850. A multicomponent site near Boxelder Creek (5-LR-256) produced a single iron projectile point, and another (5-LR-261), situated on a nearby ridgetop, yielded a single glass trade bead. Site 5-LR-110 contains tipi rings and ceramics and 5-LR-293 is a low terrace site consisting of a petroglyph panel depicting a horse and Indian rider. The Lykins Valley site (5-LR-263), situated on the bank of Boxelder Creek, is a particularly rich deposit that yielded such artifacts as stone points, blue and white glass seed beads, historic clay pipe fragments, and a gun flint. Morris assigns this assemblage to the historic contact period (AD 1725-1850) with a possible Kiowa Apache association. She also notes that a major portion of the trade goods from the site fits Preston Holder's 1935 trait list of goods diffused to the Indians by French fur traders. Two additional archaeological sites in Colorado include 5-LR-883, which is described as Arapaho Indian tipi rings, and the Hatch site (5-WL-38), which Wood (1967) reports as containing tipi rings dated to less than 160 BP.



F.E. WARREN AFB HISTORIC DISTRICT / HISTORIC LANDMARK

FIGURE NO. 2.6.4-7

Wyoming evidence includes the Morrison site (48-PL-301), situated west of Wheatland on the Laramie River, where a series of stone circles and a single metal point were noted in addition to stone points and bison bones. Also in Platte County, just south of Glendo, the burial of a woman (48-PL-51) was found with the upper body wrapped in bark and hide and covered with 18 rough pine slabs. In Laramie County, obsidian and Hartville Upland jasper artifacts found at 48-LA-459 are thought to date possibly from the Protohistoric period. Site 48-LA-223, also designated as Protohistoric, revealed lithic debitage, a blue glass seed bead, a pottery fragment, and bone fragments as surface evidence (Hunt 1981). In Albany County at Bell Cave (48-AB-304), a Protohistoric cave burial has been reported.

According to the ethnographic literature, several areas were used during this time, but although tangible evidence of such use has not been found. Wedel (1961) writes that lodgepole pine was the preferred material for tipi poles and that stands nearest the Plains were frequently used. General locations include the Black Hills, the Cypress Hills (in the Laramie Range at the head of Lodgepole Creek), and the eastern slopes of the Big Horn Mountains. Two ethnographic camp locations include the mouth of Beaver Creek on the South Platte River in northeast Colorado, where the main camp of the Cheyenne was situated in 1853 (Hewes 1948), and the South Platte River at the mouth of Crow Creek, where a camp of Cheyenne, Arapaho, and Atsend was located in about 1831 (Grinnell 1956).

Adjacent to the ROI, an example of a Protohistoric Shoshonean campsite is the Eden-Farson site in the upper Green River Basin in Wyoming, dating to 230±100 BP. Remains of over 200 antelope were recovered from 12 lodges. Evidence of seed, insect, and small animal gathering suggests a Great Basin subsistence pattern. Several sherds of flat-bottomed pottery also were noted (Frison 1971). Other locations of finds representing this period include the Medicine Lodge Creek site, the Absaroka Mountains, the Bighorn Mountains, the Wind River Mountains, as well as the shore of Seminoe Lake in Wyoming. Cultural remains noted include small stone side-notched and base-notched projectile points along with horse bones, metal and hand-hammered brass points and fragments, trade beads, knives with nicked beveled edges, as well as sherds of fired clay and carved steatite vessels (Frison 1978).

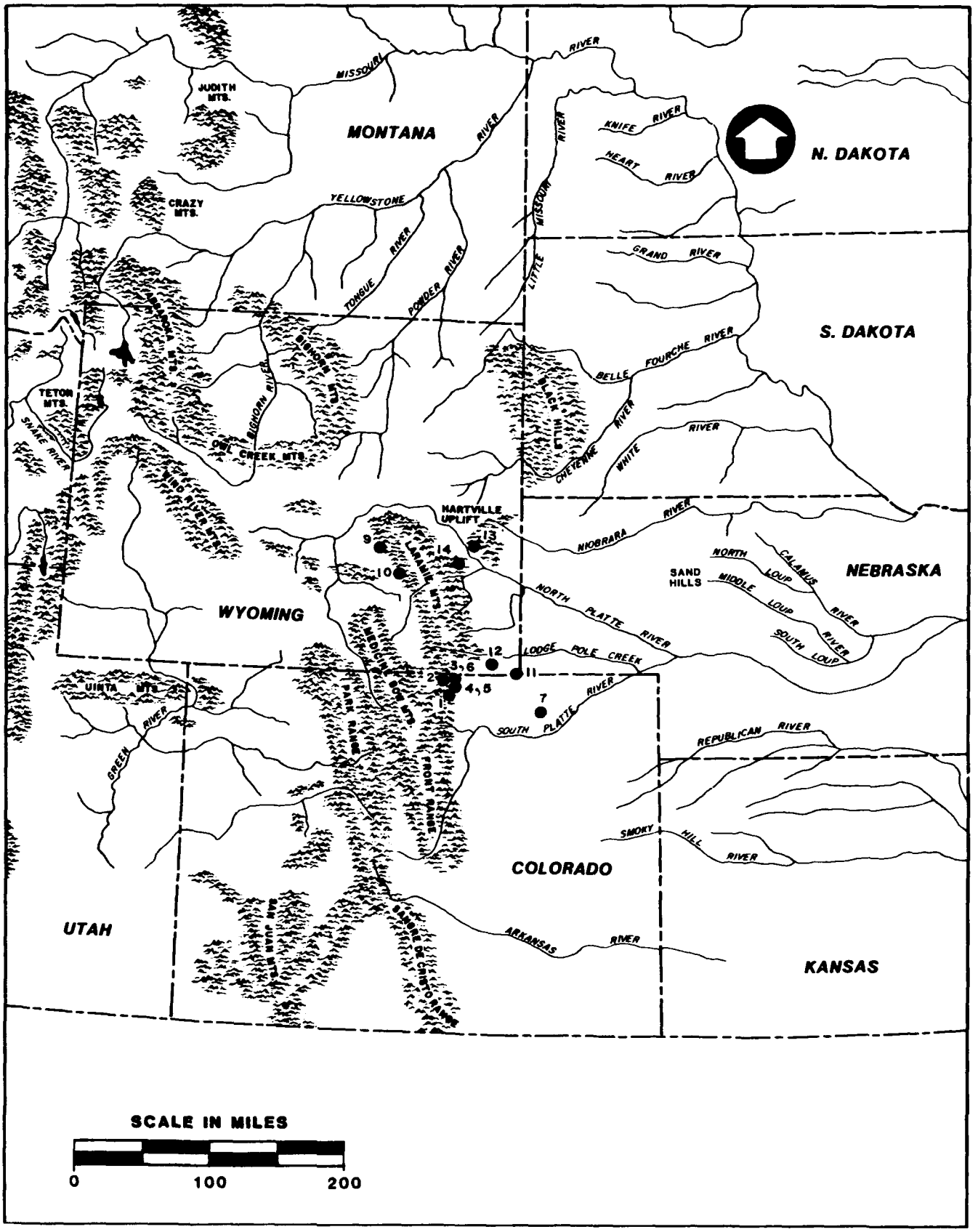
Frison (1978) reports that wooden structures (e.g., game procurement traps, corrals, log dwellings, and juniper tree shelters) are occasionally found but are rapidly disappearing. In some instances, tipi-like foundation structures have been reported within caves and rockshelters. Zeimens and Walker (1977) have noted that isolated low walls, stone piles, and other such features have been found on high buttes and cliffs.

Reconnaissance inventory of those portions of F.E. Warren AFB subject to direct project impacts identified no definite evidence of historic American Indian occupation or use; however, 29 previously unrecorded archaeological loci of historic Euramerican activity were identified. Eleven of these consist of isolated artifacts and 20 exhibit sufficient cultural remains to warrant site designations (Table 2.6.4-2). Although several of the sites included within this inventory have been so altered by past land use activities that they no longer possess contextual integrity, the remaining sites may have the potential for contributing to an understanding of the early military presence in the region and its role in the historical development of this region. For example, two of these newly recorded sites appear to date to the first military presence at Fort D.A. Russell (1867), and another site

Key to Figure 2.6.4-8

Selected American Indian Protohistoric/ Early Historic Period Sites

1. 5-LR-256
2. 5-LR-560
3. Lykins Valley
4. 5-LR-261
5. 5-LR-260
6. 5-LR-293
7. Hatch
8. Arapaho Indian Tipi Rings (not mapped)
9. Chalk Hills
10. Bell Cave
11. 48-LA-223
12. 48-LA-459
13. Glendo Burial
14. Morrison



SELECTED AMERICAN INDIAN PROTOHISTORIC/EARLY HISTORIC PERIOD SITES

FIGURE NO. 2.6.4-8

Table 2.6.4-2

INVENTORY OF KNOWN HISTORIC ARCHAEOLOGICAL SITES AT F.E. WARREN AFB

Site Number[1]	Site Type	Time Period	Potential National Register Eligibility[2]
48-LA-71[a] (FEW 14)	Historic dump	1860-1920	Undetermined: contains intact stratified deposits and features dating to earlier use of Fort D.A. Russell; additional data needed
48-LA-71[a] (FEW 24)	Historic artifact scatter	Undetermined	Eligible: appears to have intact subsurface deposits; additional data required
48-LA-71[a] (FEW 62)	Building foundation remnant and historic debris	Undetermined	Undetermined: sites includes remnants of structures and associated historic debris; additional data required
48-LA-246	Historic dump; dates to 1941 (post dump) and earlier (possibly associated with Camp Carlin)	1860-1941	Undetermined: contains intact buried deposits possibly associated with Cheyenne Depot; additional data required
48-LA-248	Surface and subsurface historic artifact scatter	1900-1925	Not eligible: heavily disturbed by WWII bulldozer activity
48-LA-249	Historic trash scatter	1880-1930	Not eligible: artifacts occur in redeposited context; site lacks structural integrity
48-LA-260	Light scatter of prehistoric lithic debitage and historic artifacts	Undetermined	Eligible: mixed prehistoric and historic debris; additional data required
48-LA-261	Rocklined depressions with historic structural remains and historic artifacts	Undetermined	Eligible: site represented by two partially intact structural features; additional data required
48-LA-262	Scatter of prehistoric lithic artifacts and historic debris	Undetermined	Eligible: mixed prehistoric and historic debris; additional data required
48-LA-263	Light scatter of prehistoric lithics and historic glass fragments	Undetermined	Eligible: mixed prehistoric and historic debris; additional data required

Table 2.6.4-2 Continued, page 2 of 2
F.E. WARREN AFB HISTORIC SITE INVENTORY

Site Number[1]	Site Type	Time Period	Potential National Register Eligibility[2]
48-LA-266	Moderately heavy scatter of historic debris/dump; may be associated with D.A. Russell laundress quarters	Undetermined	Eligible: additional data required
48-LA-269	Historic dump; contains remnant of structural feature	Undetermined	Not eligible: site is a mixture of historic and recent debris in a highly disturbed context; possible historic firing range location
48-LA-273	Historic debris scatter/dump	Undetermined	Eligible: site is an extensive dump possibly dating to 1920-1930 or earlier; additional data required
48-LA-275	Historic dump	Undetermined	Undetermined: site integrity in question; potentially dates from WWII era; additional data required
48-LA-278	Subsurface scatter of bone and historic debris; possible association with Camp Carlin (1867)	Undetermined	Eligible: contains intact subsurface deposits and at least one buried feature; additional data required
48-LA-280	Historic dump; military residential area and associated refuse; structural features present	1860-1930	Eligible: major portion of site appears intact and contains assemblage reflecting wide range of activities; additional data required
48-LA-281	Light prehistoric lithic scatter and historic debris scatter	Undetermined	Eligible: mixed prehistoric and historic debris; additional data required
48-LA-282	Subsurface scatter of historic debris	Undetermined	Undetermined: disturbed context; additional data required

[1] Site numbers are designated according to the Smithsonian Trinomial Numbering System: 48 = Wyoming; LA = Laramie County; and a series number corresponding to the numeration of sites within the County.

[2] Eligibility determinations are based on preliminary Air Force evaluations. Concurrence from the Wyoming State Historic Preservation Officer will be sought before final determinations are made.

[a] This site partially lies within the Historic District/Landmark and was assigned the Landmark's site number by the Wyoming State Historic Preservation Office.

(48-LA-246) may be a refuse accumulation related to the U.S. Army's Cheyenne Depot (Camp Carlin) installation (1867). Those sites found to contain historically important archaelological remains will be accorded further management consideration.

In addition to archaeological sites, the historic cultural resource inventory includes several standing structures in the ACS (Table 2.6.4-3). The nearly 200 buildings and associated landscaping and open spaces included within the F.E. Warren AFB Historic/National Landmark constitute the single most important collection of standing historical structures in the area, and several of these will be altered or removed as a result of emplacement of project functions and the displacement of certain onbase functions. Insofar as offbase resources are concerned, several structures of potential historic importance occur within the QD zone around each LF. These sites typically are associated with the historical development of agriculture or ranching in the region and may provide important information about the evolution of the rural cultural landscape.

2.6.4.3 Summary of Expected Resources

This section discusses the range and types of protohistoric and historic properties that can be expected to occur within the ROI. The narrative is arranged largely according to the same themes that were used to structure the overview presented in Section 2.6.4.1 and draws upon existing inventory data, the documentary record, and professional experience.

2.6.4.3.1 Fur Trapping

Much of the fur trapping activity was concentrated in the southwest portion of the ROI along the eastern margins of the Rocky Mountains. Historic sites associated with this activity can be expected to contain little evidence of long-term occupation or use and may include scattered, temporary camps located along perennial streams or springs. Although many camps are likely to occur within the region, the probability of encountering their physical remains is quite low. Consequently, the identification and analysis of virtually any trapper's camp could provide valuable information about this early historic activity. Of particular interest in this regard would be any sites discovered in portions of the ROI located in Wyoming and Nebraska, where trapping activity was much less prevalent.

2.6.4.3.2 Exploration

The north and south branches of the Platte River provided natural access to areas included in the ROI. Expeditions headed by Stansbury, Fremont, Bryan, Powell, and Hayden, to name but a few, traversed, mapped, and gathered information from the region and may have occupied temporary camps along stream courses or near reliable springs. Evidence of these camps may be represented by hearths and historic artifacts. Due to their ephemeral nature, however, it may not be possible to assign such sites to a particular expedition. Nevertheless, historic journals or diaries written by expedition members may help confirm the locations, identities, and occupation dates of such sites.

Table 2.6.1-3

INVENTORY OF STRUCTURES POTENTIALLY AFFECTED BY THE PROPOSED ACTION

Resource Description	Location	Original Function & Construction Date	National Register Status/Eligibility	Present Use	Historic Integrity
Bldg. 34	F.E. Warren AFB	Hospital 1909-1911	Historic District/ National Landmark	Security police headquarters	Long-term minor modifications of original exterior & basement due to modernization, but roofline & structure mostly intact & original fabric & appearance retained; interior has been altered by modular office construction & drop ceilings, but few permanent modifications & still largely intact
Bldg. 152	F.E. Warren AFB	Medical Corps barracks 1938	Historic District/ National Landmark	Temporary dormitory	Substantially intact exterior; doors (inside) replaced but original interior features largely present and intact
Bldg. 250	F.E. Warren AFB	Artillery barracks 1909	Historic District/ National Landmark	Wing Headquarters	Substantial alteration of original exterior by removal of original front & rear porches, replacement of windows, & addition of stairwell; 1st story interior converted to office space with modular construction but original fabric intact; 2nd story unused at present & largely intact
Bldg. 330	F.E. Warren AFB	Artillery band stable 1909	Historic District/ National Landmark	Housing; Vacant	Original exterior; interior substantially modified
Bldg. 332	F.E. Warren AFB	Artillery stable 1909	Historic District/ National Landmark	Missile vehicle & equipment control; field-team administration; security; missile guidance control system	Substantial post-1940 incompatible addition to & modification of original exterior & building plan but much of original fabric intact; interior steel support structure added to original building
Bldg. 336	F.E. Warren AFB	Artillery stable 1909	Historic District/ National Landmark	Special vehicle & missile maintenance shops	Substantial post-1940 incompatible addition to & modification of original exterior & building plan but much of original fabric intact; interior paneling & drop ceiling added but basic fabric intact
Bldg. 340	F.E. Warren AFB	Artillery stable 1909-1911	Historic District/ National Landmark	Electronics laboratory and maintenance training	Roof, windows, & west wall substantially altered by post-1940 addition, but portions of original wall intact; interior fabric basically intact with addition of paneling & drop ceilings

Table 2.6.4-3 Continued page 2 of 2
INVENTORY OF STRUCTURES

Resource Description	Location	Original Function & Construction Date	National Register Status/Eligibility	Present Use	Historic Integrity
Bldg. 389	F.E. Warren AFB	Artillery commissary & ordnance storehouse 1910	Historic District/ National Landmark	Vacant	Original exterior & interior fabric intact, including most of original fixtures, but presently undergoing remodeling
Bldgs. 801-806	F.E. Warren AFB	WWII motor vehicle maintenance facilities 1941	Eligible	Warehouse & storage with office space	Modified by addition soon after original construction; original exterior finish deteriorated & replaced; extensive interior reconfiguration (partitions, drop ceilings) but general plan remains
Bldg. 1250	F.E. Warren AFB	WWII Communications facility	Undetermined	Communications facility and helicopter hangar	Interior reported to have been modified extensively in 1960, but exterior appears to be substantially intact
House & Associated Stable (25BN9)	Launch Facility C-11; Banner County, Nebraska; on private property	Undetermined	Undetermined	Agriculture; unoccupied	No standing structures exist but possible archaeological materials in subsurface deposits
Square one-story log (?) house & associated out-building	Launch Facility A-8; Laramie County, Wyoming; on private property	Undetermined pre-1900 (?)	Undetermined for both structures	Undetermined for both structures; unoccupied	From visual inspection, original exterior appears to be intact; interior not inventoried
Small rectangular house, grain storage facilities, sheds, & a barn	Launch Facility C-7; Banner County, Nebraska; on private property	Farm complex; undetermined date	Undetermined for all structures; potential architectural values	Agricultural; occupied	Unable to determine condition by visual inspection
One-story frame house; frame barn & shed, 6 Quonset huts & other structures	Launch Facility C-7; Banner County, Nebraska; on private property	Farm complex pre-1925 (?)	Undetermined for all structures except Quonset huts, which are not eligible	Agricultural; probably occupied	Unable to determine condition by visual inspection
One-story frame house with small frame barn, 2 frame sheds, 1 metal silo, & small concrete building	Launch Facility E-10; Laramie County, Wyoming; on private property	Farming complex; undetermined date	Undetermined	Agricultural	Intact

2.6.4.3.3 Overland Migration

During the 1850s and 1860s, prior to the construction of the transcontinental railroad system, migrants traveling to the Utah, Oregon, and Colorado territories passed through western Nebraska, Colorado, and southeast Wyoming along the Oregon, Overland, and Lodgepole Creek trails. Wagon ruts and graffiti attest to the locations of portions of these trails within the ROI, and additional traces of the routes await discovery. Extensive archaeological analyses of trash dumps, habitation areas, and structural remains at trading posts and temporary camps would contribute valuable information about the lifeways of the emigrants, as well as augment information obtained from documentary sources. Comparison with data recovered from homesteads, early farmsteads, and ranches could improve current understanding of the processes whereby emigrants adapted to the environment of the Great Plains. In addition, it may be possible to confirm statements in the literature (e.g., Stansbury 1853) that migrants discarded items that they could no longer carry as they moved west across the Plains. These items perhaps could give clues about the migrants' points of origin, ethnic affiliations, and changing attitudes about the kinds of material goods that were necessary on the frontier.

2.6.4.3.4 Relations Between the Military and American Indians

No major battles of the Indian wars were fought in the area included within the ROI; therefore, large-scale battleground sites are not expected. Nevertheless, between 1867 and 1879, scattered raids and skirmishes occurred, and evidence of such small-scale battle sites may occur within the study area. These resources are likely to reveal both military and Indian artifacts, including gun parts, military buttons, lithic materials, and fire hearths. Because few sites of this type have been discovered in the region to date, much information can be gained about the location, nature, and size of these skirmishes.

American Indian encampments often were situated adjacent to forts and trading posts (e.g., Robidoux Trading Post, Fort Laramie), and small unofficial "reservations" were sometimes established immediately outside early towns. Similarily, Indian scouts are reported to have camped in the vicinity of the military units to which they were attached. In many cases, urban development probably has obliterated evidence of such encampments, but traces still may exist in rural areas.

2.6.4.3.5 Military Installations

Military operations played a major role in the exploration and settlement of the region. Although many facilities existed for only a short period of time (e.g., Camp Collins [1864-1873], Camp O.O. Howard [1885], Camp Walbach [1857-1859]), others had much longer periods of use (e.g., Fort D.A. Russell, Fort Laramie) and became focal points of emigrant travel and settlement. Army records provide considerable documentation of the locations and structural aspects of these installations but archaeological recovery techniques have not been used extensively to confirm or expand upon existing data. Consequently, these sites may offer interesting and valuable information about military camp life by illustrating soldiers' adjustments to the High Plains environment.

Fort D.A. Russell (now F.E. Warren AFB) was instrumental in the development of Laramie County and has considerable archaeological potential for contributing

to a general understanding of southeast Wyoming history. In 1969, an Historic District (Figure 2.6.4-7) was established on the base to preserve the character and integrity of its older buildings. Currently listed buildings include 19 pre-1900 structures and 75 structures built between 1900 and 1911; numerous other structures both inside and outside the District also may be NRHP-eligible.

The original evaluation and nomination of the District to the NRHP was based solely on its architectural merits and contributions to the broad pattern of military history. It never has been evaluated fully in terms of its historic archaeological potential. Archaeological remains both in the District and immediate vicinity may date to as early as 1867, when Camp Carlin (Cheyenne Depot) and Fort D.A. Russell were established, and artifacts from all periods of occupation could fill many gaps in current knowledge of military life at these posts. Information also could be gained concerning relationships between the military and civilian populations of the region, thereby increasing understanding of the Fort's role in the general history of the area.

Onbase archaeological remains may include remnants of the original tent and log encampment associated with Fort D.A. Russell that may add to knowledge about the layout of the facility, the individuals who lived there, and the specific kinds of activities that took place there. Evidence of the wood frame barracks completed between 1867 and 1868 also might be located. Because these structures housed enlisted men, artifacts may occur that give insight into how spare time was used and how military personnel divided and used their personal space. Other expected archaeological resources include activity areas that may provide information about other aspects of day-to-day life on the base. In addition, buried structural remains and associated artifacts spanning the Fort's entire history can be expected, and these may provide important data about all phases of the installation's development.

2.6.4.3.6 Mining

In Laramie County, mining activities were restricted to the Hecla and Silver Crown districts. These ventures were short-lived and little silver actually was removed. From an archaeological perspective, these mines and the towns adjoining them can contribute information about life in mining communities, and the mines themselves may contain important data relating to early ore extraction technology.

Elsewhere in the ROI, particularly in Colorado, more extensive operations to extract coal or gold and silver ore occurred, but only coal mining in Weld County continued as a long-term commercial venture. Nevertheless, numerous traces of short-lived placer mining activity still were evident in the early part of the twentieth century, particularly in the Medicine Bow Mountains (Watrous 1911), and may yet exist.

2.6.4.3.7 Homesteading

Abandoned homestead, ranch, and farmstead sites are numerous in the ROI especially in the eastern and southern portions, where rainfall was greatest. Historic homesteads and farmsteads usually consist of one or more of the following components:

- Multiple foundations: rock-lined depressions in the ground or stone alignments on the surface. Living quarters often had a partial hand-dug cellar used as a root cellar with an outside entrance consisting of an inclined trench, with or without stairs. Root cellars also may be found dug into the side of an embankment. These features usually are located away from the main building and should not be confused with "dugouts," which were occupied until a more suitable dwelling was erected.

- Outbuildings: sheds and small barns often represented by stone alignments on the ground surface (not always continuous). Lumber and building materials were scarce and usually were removed from an abandoned location and used elsewhere.

- Hand-dug wells or enlarged springs: these usually are present unless a stream or other water source was nearby. They may be rock-lined and the rocks covered with mortar.

- Trash concentrations: these often are present, increasing in size and number with the length of habitation. Trash concentrations several feet deep may be found in abandoned privy holes, old arroyos, or natural depressions. Surface dumps for household wastes also are common. Some homesteaders disposed of refuse adjacent to their dwellings; however, dumpsites were usually placed far from the residence for sanitary reasons.

- Small depressions in the ground: these may indicate previous privy locations and, if so, may yield numerous diagnostic remains such as medicine bottles.

- Cisterns: stone or concrete-lined pits that were used to catch and store rainwater or snow melt, mainly from rooftops. Cisterns often were located adjacent to the house, usually at a corner.

2.6.4.3.8 Transportation

With the introduction of stage lines, mail routes, and railroads to the region in the 1860s, it became necessary to develop numerous stations, supply/labor camps, stock ranches, and roads. Many of these were complexes of structures, corrals, and housing facilities that can offer a wealth of information concerning living and working conditions and day-to-day operations.

The Union Pacific Railroad was a major impetus to initial settlement of the region; however, to date, no sites associated with its construction have been discovered. It is expected that such sites, including watering stations and construction camps, may be encountered, and these could contribute information concerning the daily domestic activities of the construction crews that occupied them.

Railroad sites are limited to linear corridors that often varied to remove the need for curves and bridges or to ease grades. The kinds of railroad-related sites expected within or near these corridors include: original construction camps, temporary end of track towns, stations, water stops, section camps and towns for track maintenance, stock-loading pens, coal tipples, mine spurs, sidings, wyes, abandoned roadbeds, bridges and tunnels, and sites of derailments and accidents. These narrow corridors experienced a high level of

human activity over an extended period of time, and this increases the probability of finding sites within such alignments.

Two historic sites associated with the Union Pacific that have been determined to be eligible to the NRHP are Granite Station and Hazard Station. Granite Station (Granite Canyon Station) was a combined railroad depot and post office (ca. 1869). Although the original building is no longer standing, site significance was established by its association with the famous author, Marial Harris, who used the Post Office. From an archaeological standpoint, this site may hold information relating to early railroad technology. Hazard Station (Hazard Point Station) is dated approximately to the same period and originally was located on the feeder line to Fort Collins, Colorado. Although the original depot no longer exists, its archaeological remains may contribute to knowledge of early railroad technology.

In general, a study of railroad sites, including spurs that ran through Camp Carlin and Fort D.A. Russell, could broaden the body of general knowledge of railroad history. Furthermore, such sites could yield information important to explaining the interrelationships of the railroad with various other aspects of regional history, particularly the degree to which the railroad served as an adaptive force in the area.

2.6.4.3.9 Urban Development

As discussed previously, many of the urban areas in the ROI possess historically and architecturally important sites and structures reflecting particular phases of urban growth. Most of these have been evaluated in terms of style, aesthetics, or mode of construction, but few have been examined archaeologically. Furthermore, few urban areas have been inventoried in a systematic fashion, and there is little doubt that such an inventory would reveal the presence of numerous additional historically important properties. Such inventories would be particularly productive in the smaller towns of the region. Torrington, Kimball, Scottsbluff, Wheatland, and numerous other towns in the ROI contain historical properties within their municipal limits, but the evaluation of these properties often has not been systematic or comprehensive.

Many of the region's towns are agricultural communities that grew out of the dry farming homestead boom and prospered between the years 1905 and 1925. Although several are now abandoned, others (e.g, Carpenter and Albin) remain occupied. Archaeologically, these sites may contribute to general knowledge of the lifeways of early settlers within the region. Archaeological investigations in such areas could demonstrate the relationship of these town sites to major urban centers, rural populations, and the railroad. In addition, these sites are integral to understanding the relationship between settlers and the natural environment. For example, the town of Federal was to be a "planned" agricultural community placed strategically on the route of the Colorado Southern Railroad. The inability of its developers to locate sufficient water for irrigation, however, caused the eventual demise of the community.

2.6.4.3.10 American Indian Occupation

In addition to expected Euramerican loci of occupation and use, the ROI should contain evidence of continued American Indian habitation of the area during the Protohistoric and Historic periods.

Based on the ethnographic and early historic record, it is apparent that archaeological evidence should be scattered throughout the ROI in much greater density than is known at present. While much of Plains Indian material culture is not expected to have survived the passage of time, particular types of domestic activities are expected to have left evidence that will support, refute, or fill gaps in the written record. These remains will also add to our knowledge of the little known Protohistoric period. Expected site types include:

- o Campsites of short or long duration indicated by stone circles, post molds, packed floors, hearths, and food processing and workshop areas. Longer term camps are expected in sheltered stream valleys or broken areas where water, wood, and forage were available;
- o Food gathering and processing sites indicated by light artifact scatters, pit or rock cairn food caches, and bone scatters;
- o Tools left as remnants of log cutting in wooded areas bordering the plains;
- o Hunting sites indicated by rock alignments (for antelope or bison hunting), eagle catcher pits, rock cairn lookouts, and butchered bone concentrations; and
- o Wooden structures such as traps, corrals, and shelters.

2.6.5 Paleontological Resources

This section describes the paleontological resources of the ROI. Section 2.6.5.1 provides an overview of previous research in the ROI. Section 2.6.5.2 summarizes the known paleontological resources within the ROI and describes the extent of surface exposure of fossiliferous geologic units, number of localities, and significance of the fauna and flora. Expected paleontological resources are described in Section 2.6.5.3 and evaluated with respect to their sensitivity to project-related activities.

2.6.5.1 Overview

2.6.5.1.1 Sources of Data

Fossil material has been found in almost all the formations that crop out in the ROI. Collections from known localities are housed at several institutions in the United States: American Museum of Natural History, New York; Peabody Museum of Natural History, New Haven; United States National Museum, Washington DC; Field Museum of Natural History, Chicago; University of Nebraska, Lincoln; University of Wyoming, Laramie; and the University of Colorado, Boulder. These institutions have been contacted and data provided by them used to establish the scientific importance of potential paleontological resources in the ROI. In addition to collections from recorded localities, fossil material has been reported from geologic units for which no formal localities have been established. Although fossils have been reported from most of the sedimentary units in the ROI, the productivity and paleontological importance of these strata vary widely.

Table 2.6.5-1

POTENTIAL PALEONTOLOGICAL RESOURCES BY GEOLOGIC UNIT

Geologic Unit	Geographic Distribution of Surface Exposures	Paleontological Resources	Scientific Importance
Quaternary	Along major drainages in all counties.	Rodents, rabbits, camels, antelopes, horses, bison, carnivores, Late Pleistocene bison, horse, and camel, mammoths, martins, wolverines, pikas, lemmings within the ROI.	Low
Ogallala Formation	Extensive exposures in Weld, Banner, Kimball, and Laramie counties. Very limited exposures in Larimer County.	Insect, insectivores, fish, reptiles, birds, carnivores, proboscidenas, ungulates, rodents, and rabbits in ROI.	Moderate
North Park Formation	Limited exposure in Larimer County.	Very little fossil material.	Low
Arikaree Formation	Extensive exposures in Goshen, Platte, Laramie, and Banner counties. Limited exposures in Albany, Weld, and Scottsbluff counties.	Fish, amphibians, reptiles, birds, marsupials, insectivores, carnivores, ungulates, rodents, and rabbits in ROI.	Low to Moderate
White River Formation	Exposures in 7 of 9 counties in ROI. Extensive exposures in northern half of Weld County, southern half of Goshen and Platte counties, and Scotts Bluff County. Limited exposures in Albany, Laramie, and Larimer counties.	Invertebrates, fish, reptiles, amphibians, marsupials, insectivores, primitive and modern carnivores and ungulates, rodents, edentates, and rabbits reported within the ROI.	Moderate
Wagon Bed	Limited exposures in Albany County.	Primates and perissodactyls reported within ROI.	Low
Hanna Formation	Limited exposures in Albany County.	Plants found in areas outside ROI. Very little reported in ROI.	Low
Wind River Formation	Albany County.	Birds, reptiles, insectivores, rodents, archaic ungulates, ungulates, archaic carnivores, carnivores, and primates reported in ROI.	Low
Laramie Formation	Extensive exposures in Weld County.	Localities within the ROI have produced invertebrates, fish, amphibians, reptiles, turtles, crocodiles, dinosaurs, and mammals.	Moderate
Lance Formation	Very limited exposures in Goshen County.	Fish, reptiles, turtles, crocodiles, dinosaurs, and mammals outside ROI. Few fossils collected in ROI.	Low
Fox Hills Sandstone	Limited exposures in Larimer and Weld counties.	Mostly marine remains and some mammals. Mesosaur collected in Logan County, Colorado. Little collected in ROI.	Low
Medicine Bow Formation	Small exposure in Albany County.	Numerous plants and some dinosaur material outside ROI. Little reported in ROI.	Low
Lewis Shale	One small exposure in Albany County.	Marine invertebrates and fish bones and scales outside ROI. Little inside ROI.	Low
Mesaverde Formation	Limited exposures in Albany and Larimer counties.	Not a productive unit.	Low
Pierre Shale	Upper Pierre in Weld County, lower, middle and upper in Larimer County.	Marine invertebrates. One recorded invertebrate locality in Larimer County.	Low
Steele Shale	Limited exposures in Albany and Laramie counties.	Numerous marine invertebrates outside ROI. Nothing in ROI.	Low

Table 2.6.5-1 Continued
POTENTIAL PALEONTOLOGICAL RESOURCES BY GEOLOGIC UNIT

Niobrara Formation	Limited exposures in Laramie and Albany counties.	Large quantities of marine invertebrates and some fish bones outside ROI. Mesosaur collected near Fort Collins.	Low
Frontier Formation	Limited exposures in Laramie and Albany counties.	Numerous marine invertebrates, fish bones and scales, and mammal remains outside of ROI. Very little reported in ROI.	Low
Thermopolis Shale	Limited exposures in Platte, Albany, and Laramie counties.	Numerous marine invertebrates, fish bones and scales, and dinosaur remains outside ROI. Little reported in ROI.	Low
Mowry Shale	Limited exposures in Platte, Albany, and Laramie counties.	Numerous marine invertebrates, fish bones and scales, and dinosaur remains outside ROI. Little reported in ROI.	Low
Codell Sandstone	Along Front Range and Medicine Bow Mountains in Larimer County.	Sharks teeth outside ROI. No reported localities in ROI.	Low
Cloverly Formation	Limited exposures in Albany County.	Mammals, turtles, and dinosaurs outside ROI. No reported fossil materials in ROI.	Low
Morrison Formation	Along Front Range in Larimer County, several exposures in Albany County, limited exposures in Platte and Larimer counties.	Localities in Albany County have produced plants, fish, freshwater invertebrates, amphibians, mammals. Has produced a diverse dinosaur and mammal assemblage.	High
Sundance Formation	Along Front Range in Larimer County, limited exposures in Platte, Albany, and Laramie counties.	Marine invertebrates and reptiles outside ROI. No recorded localities in ROI.	Low
Helm Formation	Limited exposures in Albany and Larimer counties.	Very few remains from outside ROI. No localities in ROI.	Low
Lykins Formation	Small exposure in Front Range in Larimer County.	Marine invertebrates outside ROI. No recorded localities in ROI.	Low
Lyons Sandstone	Small area in southeastern Larimer County.	Amphibian footprints (Boulder County, Colorado). No reported remains in ROI.	Low
Satanka Shale	Limited surface exposures in Albany County.	Marine invertebrates outside of ROI. Very little reported in ROI.	Low
Forelle Limestone	Limited surface exposures in Albany County.	Marine invertebrates outside of ROI. Very little reported in ROI.	Low
Hartville Formation	Limited exposures in Goshen and Platte counties.	Marine invertebrates but very few remains reported within ROI.	Low
Casper Formation	Limited exposures in Larimer, Platte, Albany, and Laramie counties.	Numerous marine invertebrates outside ROI, but few reported within ROI.	Low
Ingleside Formation	Limited exposures in Larimer County.	Marine invertebrates outside ROI, but little reported in ROI.	Low
Fountain Formation	Limited exposures in Larimer County.	Marine invertebrates outside ROI, but little reported in ROI.	Low
Guernsey Formation	Limited exposures in Platte and Goshen counties.	Marine invertebrates and Late Devonian marine fossils outside ROI. Little reported in ROI.	Low
Madison Formation	Limited exposures in Platte and Albany counties.	Numerous marine invertebrates outside ROI. Only a few remains reported in ROI.	Low

Table 2.6.5-2

REPORTED PALEONTOLOGICAL LOCALITIES BY COUNTY AND GEOLOGIC UNIT[1]

Formation	Wyoming				Nebraska			Colorado		Total	
	Albany	Platte	Goshen	Laramie	Scotts Bluff	Banner	Kimball	Weld	Larimer	#	%
Recent	-	1(1)	-	-	-	-	-	-	-	2	1
Quaternary	-	-	4(1)	-	2	1	-	1	3	12	6
Pliocene	-	-	-	1	-	-	-	-	-	1	<1
Ogallala	-	1	-	6	-	17	3	8(1)	-	46	21
Arikaree	-	18	33	-	2	5	-	(1)	-	59	26
White River	6	5	15(1)	-	3	1	-	23	-	54	24
Lance/Laramie	-	-	-	-	-	-	-	3	-	3	1
Wagon Bed	2	-	1	1	-	-	-	-	-	2	1
Wind River	2	-	-	-	-	-	-	-	-	2	1
Pierre Shale	-	-	-	-	-	-	-	-	1	1	<1
Morrison	3(15)	-	-	-	-	-	-	-	-	18	8
Unknown	7	2	1	2	10+	-	-	-	1	23+	10+
TOTAL:	35	28	55	9	17+	24	3	47	5	223	
Percent of Total	16	13	25	4	8	11	1	18	2	99	

Note: 1 Numbers in parentheses indicate localities with questionable formation assignments.

2.6.5.1.2 Previous Research

The majority of previous paleontological studies have concentrated on Mesozoic and Cenozoic strata. Little work has been done with Paleozoic strata other than micropaleontological studies associated with oil and gas investigations (Love and Weitz 1953). Consequently, Paleozoic vertebrate fossil resources are relatively unknown.

Several investigators have studied faunas associated with specific geologic units or sediments of a given age (Cope 1873, 1878; Matthew 1899, 1901, 1918; Osborn 1909; Hay 1927; Cook and Cook 1933; Schultz 1934; Schlaikjer 1935; Wood et al. 1941; Cook 1948). Recent investigators of Mesozoic faunas include Clemens (1963, 1973), Estes (1964), Carpenter (1979), and Clemens et al. (1979). Specialized work on Tertiary (Cenozoic) sediments has been done by Galbreath (1953), Voorhies (1965), Forsten (1970), Cassiliano (1980), and Kihn and Middleton (1980). Skinner and Hibbard (1972) and Anderson (1974) report on Pleistocene faunas, and a few researchers have investigated floras (Chaney and Elias 1936; Elias and Lugn 1939; Elias 1942).

2.6.5.2 Summary of Known Resources

Any assessment of the scientific importance of paleontological materials involves both quantitative and qualitative judgments. Qualitative considerations must include current trends in scientific paleontological research as well as general scientific notions about fossil-bearing geologic units. Quantitative aspects include the age, association, rarity or uniqueness, and type of paleontological resource. The following assessments of scientific importance are based, in part, on the probable importance of paleontological resources that might be lost due to construction activities associated with the project or to increased collecting by amateurs.

Table 2.6.5-1 summarizes the potential paleontological resources within the ROI by geologic unit. For example, formations from Paleozoic and Mesozoic geologic units generally have limited exposures in the ROI and their associated paleontological resources have relatively low scientific importance.

Over 200 paleontological localities have been reported in the ROI. Table 2.6.5-2 summarizes those localities by county and geologic unit. Of the geologic units in Table 2.6.5-2, only six have fauna or flora with scientific importance judged to be greater than low. The Morrison Formation has produced the most taxonomically diverse mammalian assemblage known from the Mesozoic (Clemens et al. 1979). Several of the taxa from the Laramie Formation have not been previously recorded in the Upper Cretaceous of Colorado, and the finds have greatly expanded the dinosaur and turtle faunas known from the formation (Carpenter 1979). The White River Formation has one of the best known Oligocene biotic assemblages in the world (Colbert 1969). Fossil material is abundant and scattered throughout the sediments, although composition does not tend to vary between localities. Specimens usually are identifiable despite generally poor preservation. Fossil material within the Arikaree Formation is not abundant and is usually found in small concentrations consisting of isolated teeth and jaw fragments. Species found within the Arikaree Formation are well known, although generally not varied or abundant within each locality.

Fossil material is not as abundant in the Ogallala Formation as the White River Formation. Fossil localities tend to be in point bar deposits from extinct alluvial channels. Areas between these deposits are relatively nonfossiliferous. Productivity and species composition differ between localities. Quaternary deposits are not as productive nor the fauna as varied as those of the Tertiary.

Late Pleistocene bison, horse, and camel are fairly common throughout Wyoming, but no known localities occur that contain ground sloths, mastodons, dire wolves, or saber-toothed cats, although they have been found in neighboring states (Anderson 1974). In addition, mammoths, martens, wolverines, pikas, and lemmings inhabited the ROI during the Quaternary; however, no clear evidence has been found in Wyoming for pre-Wisconsinan or Wisconsinan bison species (Wilson 1974).

2.6.5.3 Summary of Expected Resources

Many Paleozoic and Mesozoic geologic units in the ROI have low scientific paleontological importance (Section 2.6.5.2). Fauna within Paleozoic and Mesozoic units consist largely of marine invertebrates that are often abundant in locations outside of the ROI. In addition, Paleozoic and Mesozoic units have limited surface exposures and have produced limited or no material within the ROI.

In general, fossils could occur in any geologic unit in the ROI. Based on review of literature and locality records, it can be expected that additional paleontological localities will be found within the ROI. Localities in the Ogallala, Arikaree, and White River formations could contain representatives of all major vertebrate orders.

The geologic units identified in Section 2.6.5.2 as having low scientific paleontological importance are assigned a low sensitivity to project activities. The sensitivity of geologic units with moderate or higher importance is evaluated in the following sections based on the extent of surface exposure within the ROI, distribution of the unit outside the ROI, and productivity of the unit.

2.6.5.3.1 Morrison Formation

The fauna produced from the Morrison Formation are highly important for understanding the early stages of mammalian evolution. During the time of the deposition of the Morrison Formation, inconspicuous mammals co-existed with dinosaurs, but it was not until the extinction of dinosaurs that mammals became the dominant land vertebrates. Consequently, the fauna have high scientific importance, but the limited number of surface exposures within the ROI reduces the sensitivity of this geologic unit to moderate.

2.6.5.3.2 Laramie Formation

The fauna produced from the Laramie Formation are highly important. Specimens collected from Weld County by Carpenter (1979) provide an opportunity to study a unique faunal assemblage. Extensive surface exposures occur in Weld County; therefore, the sensitivity of this geologic unit is moderate.

2.6.5.3.3 Wind River Formation

Exposures of this formation in Albany County are the southeasternmost extent of early Eocene deposits in the ROI. Localities within the ROI are productive, and faunas vary between localities. The sensitivity of this formation is considered low to moderate due to limited surface exposures.

2.6.5.3.4 White River Formation

The White River Formation is the most productive of all geologic units occurring within the ROI. This formation provides an opportunity to study population dynamics, paleoecology, and evolutionary trends in organisms because extensive surface exposures occur within the ROI. A major faunal turnover took place from the Eocene to the Oligocene, and the White River data record the beginning of the development of a "modern" fauna. The fauna is well known, however, and the geologic unit is highly productive outside of the ROI. Consequently, the sensitivity of this geologic unit is only moderate.

2.6.5.3.5 Arikaree Formation

The scientific importance of the fauna from this formation is low to moderate. Faunal assemblages provide data on the evolutionary trends of modern animals such as the horse, camel, and various rodents. Numerous surface exposures occur in the ROI. In general, species are not abundant but they are well known. The sensitivity of this geologic unit is low to moderate.

The sensitivity of a geologic unit will vary between geographic areas, and is largely a function of the extent of surface exposure. Table 2.6.5-3 shows variations in sensitivity, by county, for geologic units having a moderate or higher scientific importance.

Table 2.6.5-3

PALEONTOLOGIC SENSITIVITY RANKINGS[1]

	WYOMING				NEBRASKA			COLORADO	
GEOLOGIC UNIT	Albany	Platte	Goshen	Laramie	Scotts Bluff	Banner	Kimball	Weld	Larimer
Quaternary	L	L	L	L	L	L	L	L	L
Ogallala	---	---	---	M	---	M	M	M	L
Arikaree	L	L	M	L	L	L	---	L	---
White River	L	M	L/M	L/M	L/M	---	---	L/M	L/M
Wind River	L/M	---	---	---	---	---	---	---	---
Laramie	---	---	---	---	---	---	---	M	---
Morrison	M	L	---	L	---	---	---	---	L

Note: 1 Key To Sensitivity Rankings: L - very low to low sensitivity; M - moderate sensitivity; H - high sensitivity.

3.0

ENVIRONMENTAL CONSEQUENCES, MITIGATION MEASURES, AND UNAVOIDABLE IMPACTS

3.0 ENVIRONMENTAL CONSEQUENCES, MITIGATION MEASURES, AND UNAVOIDABLE IMPACTS

3.1. Introduction

This section describes the impacts of the Proposed Action on prehistoric, historic, and American Indian cultural resources, and paleontological resources. A description of the criteria used to arrive at the level and significance of project impacts is presented along with a discussion of the procedures employed in their estimation. An important part of this discussion is focused upon identifying those assumptions and assumed mitigations that condition the results of impact analyses. Following these introductory sections, an assessment of the level, significance, timing, and geographic extent of anticipated impacts is presented for each resource element; separate consideration also is given to each component of the project that could result in direct or indirect impacts. Both the Proposed Action and project element alternatives and the No Action Alternative are considered. The section concludes with a consideration of unavoidable adverse impacts, irreversible and irretrievable resource commitments, and the relationship between local short-term use of man's environment and maintenance and enhancement of the long-term productivity of the cultural and paleontological resource base.

As noted in Section 2.3, two separate geographic areas are distinguished for the purpose of identifying and categorizing impacts to cultural and paleontological resources: 1) an Area of Concentrated Study (ACS) within which impacts may occur directly and indirectly from project activities; and 2) a Region of Influence (ROI), a larger area that is inclusive of the ACS, in which impacts may occur indirectly from project activities. The ACS actually consists of a mosaic of areas in which proposed project activities will directly result in ground disturbances and impacts to cultural and paleontological resources. These areas include portions of F.E. Warren AFB, the Defense Access Road rights-of-way, the buried cable paths, dispatch station sites, and the Launch Facilities, Launch Control Facilities, and their access roads. Although the number of individual elements involved in the ACS is relatively large, the total area involved in project ground disturbances is estimated at 1,700 acres, approximately two-thirds of which will occur along existing road rights-of-way.

The recognition of a separate ACS and ROI is tied to the kinds and locations of impacts expected as a consequence of project implementation. Because the specification of an ACS and the effects that will occur within it are totally dependent upon facilities siting decisions associated with the Proposed Action, the kinds and locations of impacts can be identified in advance of project implementation, and mitigations for most impacts can be developed and accomplished during project planning and design. On the other hand, impacts in the ROI will, by definition, be of an indirect nature. Although data are available to arrive at reasoned qualitative ratings for level of indirect impacts, the specific resources (and their locations) subject to such impacts cannot be determined in advance. Consequently, proposals for mitigation measures involving the ROI must be more general in their construction than those involving the ACS.

The information in this section is based upon data and detailed analysis contained in Section 2.6.

3.2 Definition of Levels of Impact

The level of impact (LOI) to cultural and paleontological resources is a measure of the degree to which changes over and above baseline conditions can be anticipated from project activities. For the purpose of this assessment, four qualitative ratings are used to specify the LOI associated with the Proposed Action. These are defined as follows:

- Negligible Impact - Those instances in which the project will not affect resources possessing important scientific or humanistic values;
- Low Impact - Those instances in which the project will result in finite but minimal loss of resources possessing important scientific or humanistic values;
- Moderate Impact - Those instances in which the project will result in limited loss of resources possessing important scientific or humanistic values; and
- High Impact - Those instances in which the project will result in extensive loss of resources possessing important scientific or humanistic values.

Because the terms "minimal", "limited", and "extensive" are critical components of the LOI rating definitions, consideration needs to be accorded to the meaning of these terms. In this regard, a "minimal" loss of resources possessing important scientific or humanistic values is one that results in the maintenance of a representative sample of the resource. For example, the loss of one or two archaeological sites out of a regional population of 100 of the same type would be considered a minimal loss and a consequent low impact. On the other hand, the loss of most or all sites of a given type would be considered a high impact because the resultant site sample would no longer be representative of the resource.

In addition to considering level of impact, predictions of project impacts on cultural and paleontological resources involve evaluating the type, timing, and scope of impacts to each resource element. For both cultural and paleontological resources, impacts might be either direct or indirect. Direct impacts result from disturbances occurring during project construction and operation that result in above or below-ground disturbances (e.g., modifications to structures and construction of roads). Indirect impacts are those caused by induced development and altered land use patterns.

Timing of impacts can be classified as short term or long term. Short-term impacts are direct or indirect impacts occurring during the period of project construction when ground disturbance and associated population levels are at their maximum; short-term impacts may result in changes in baseline conditions that last beyond the period of project deployment. Long-term impacts consist of those direct or indirect impacts occurring as a consequence of project peacetime operations and/or those impacts occurring during project construction that carry over to project operations.

Scope of impacts refers to the geographic area within which project impacts are perceived or predicted. For purposes of the current analysis, three areal scales are recognized: 1) site, referring to specific localities within the ACS; 2) local, encompassing municipalities, districts, parks, and other planning or management jurisdictions proximal to the project area; and 3) regional, constituting the remaining area included in the ROI.

3.3 Determination of Significance Criteria

Significant impacts to cultural resources are those that have adverse impacts on qualities and characteristics that make a prehistoric or historic cultural resource eligible for inclusion in the National Register or that make a site important to contemporary American Indian groups. Similarly, significant impacts to paleontological resources are those that have an adverse impact on the scientific importance of the resource.

3.4 Assumptions, Assumed Mitigations, and Environmental Consequences of the Proposed Action and Project Alternatives

In the sections that follow, the results of the analyses of project impacts are summarized for both the Proposed Action and project element alternatives and the No Action Alternative. In general, analysis and specification of potential impacts to cultural and paleontological resources involves projecting known and anticipated project activities onto baseline conditions and applying the criteria outlined in Sections 3.2 and 3.3 to establish level and significance of impacts. The means of accomplishing these assessments included use of available inventory data, expected resource occurrences, assumed mitigation measures, and professional judgment. For each major set of activities entailed by the Proposed Action (e.g., onbase facilities modifications, Defense Access Roads upgrading), known and expected resources were compared with the design, siting, and construction characteristics of project features in order to establish the kind, intensity, scope, timing, and importance of likely impacts.

Where reliable resource data were available for a particular project element (e.g., onbase facilities modifications) and the characteristics of that project element were well specified (e.g., internal alterations to historic structures), impact assessments have a high degree of objectivity because they can be made from full knowledge of the resource and the activities that will impinge upon those resources. On the other hand, where inventory data are lacking (e.g., the buried cable paths) or the nature of a specific project element was unspecified (e.g., the precise locations of dispatch stations), the impact analyses depend to a greater degree upon professional judgment and extrapolations from current baseline data.

Impact analyses in the latter circumstances were more conservative in their approach; that is, estimates of impact levels in these circumstances are likely to be higher than those that would have been developed if complete baseline data had been available. For example, level of impact determinations for proposed buried cable paths could draw upon knowledge of the specific construction techniques and the general locations of proposed cable path alignments but had to rely upon extrapolations from inventory data obtained from areas outside these alignments. Consequently, these extrapolations assumed that resource densities along the paths would be equal to or greater

than those noted by other researchers in similar environmental settings. A similar estimation method was used for level of impact ratings associated with proposed upgrading and widening of Defense Access Roads. On the other hand, estimates of the levels of indirect impacts associated with the project were based on the relatively small anticipated changes in regional baseline demographics and reflect the lack of specific locational information about any changes that may affect important cultural or paleontological resources.

3.4.1 Assumptions

The analysis and characterization of project impacts incorporate certain key assumptions that condition the level and significance of impact assessments. These assumptions encompass a variety of perspectives ranging from attributions regarding the reliability of current inventory data to statements about the expected variability in ongoing, nonproject-related forces affecting resources.

These assumptions are as follows:

- Existing resource inventory data, in conjunction with background research information, provide a reasonable approximation of the kinds of resources that may be expected to occur in areas for which inventory data are currently lacking.

Although much of the research performed to date within the ROI has been associated with proposed energy or water projects (e.g., McNamara 1978; Morris et al. 1979; Blatchley and Welty 1980; Commonwealth 1981; Reher 1982), many of these studies involved field analyses of rights-of-way that transected various topographic features and geomorphic provinces. Other studies (e.g., Renaud 1932; Strong 1935; Bliss 1948; Mulloy 1958; Reher 1969; Grant 1980) encompass broader areal concerns or synthesize research data for portions of the Great Plains that include the ROI. While the total area investigated to date is not great, a variety of geomorphically diverse landscapes have been sampled (e.g., Horse Creek watershed in southeast Wyoming), and in other areas (e.g., Glendo Reservoir in southeast Wyoming) numerous resources of diverse types have been recorded and excavated. These permit a reasonable reconstruction of the activities of indigenous peoples for all prehistoric periods except the earliest phase of the Paleo-Indian, for which very few sites are known. Accordingly, it has been possible for researchers (e.g., Reher 1982) to develop qualtitative models of the general distribution of resources by type and topographic feature, and these have been incorporated in the current analysis. The result is a reasonable approximation of the range of resources potentially occurring within the ROI and the ACS (Section 2.6), and such baseline projections provide a useful basis for impact assessments and management recommendations.

- Currently unrecorded or unevaluated resources exist within the ROI and ACS that possess important scientific and/or humanistic values (i.e., eligible for inclusion in the National Register).

Given the limited prior spatial coverage of the ROI and the numbers, kinds, and locations of resources that have been identified in those areas, it is reasonable to assume that numerous important resources currently exist in the ROI and ACS that have not yet been identified and evaluated. Because popula-

tion densities for much of the area are low and land use outside metropolitan zones is limited principally to ranching and farming, it also is probable that most of these sites are largely undisturbed and that many are potentially eligible for inclusion in the National Register of Historic Places (NRHP).

- The rate of ongoing natural and human factors affecting baseline conditions (e.g., erosion, agricultural practices, population growth, alteration and modifications of the built environment) will remain relatively unchanged for the foreseeable future.

Examinations of existing conditions and future trends for land use, socio-economics, transportation, energy use, utilities, water resources, and climatology conducted as part of the current study indicate that, despite projected overall population growth in the ROI, no major changes in land use patterns are likely to occur. Similarly, no major increases are expected in the demand for additional facilities such as roads, reservoirs, power generators, industrial plants, and the like that could affect large areas of the land surface. The changes that will occur are largely expected to affect metropolitan and adjoining areas, but will not alter noticeably the rural landscape. Because rainfall, erosion, and other natural agencies are expected to remain relatively constant for the foreseeable future, the amount of disturbance to cultural resources resulting from these agencies should not vary appreciably from existing baseline conditions.

3.4.2 Assumed Mitigations

For prehistoric and historic cultural resources Air Force policy is to:

- Provide leadership in the preservation of the prehistoric and historic resources of the United States;
- Assume responsibility for the preservation of historic properties under Air Force control;
- Direct policies, plans, activities, and programs to the maximum extent possible to minimize harm to sites, structures, and objects listed in the National Register or eligible for listing;
- Initiate procedures to assure that good faith consultation with the Advisory Council on Historic Preservation (ACHP) and appropriate State Historic Preservation Officers (SHPOs) occurs prior to undertaking any action that could adversely affect sites, structures, and objects listed in the National Register or eligible for listing; and
- Locate, inventory, and nominate to the Secretary of the Interior all sites, buildings, districts, and objects under Air Force jurisdiction that appear to qualify for listing in the National Register.

Based on these policies, the Air Force will, in consultation with the ACHP and the Wyoming and Nebraska SHPO, develop and implement a Programmatic Memorandum of Agreement (PMOA) for the treatment of prehistoric and historic cultural resources affected by the Proposed Action; it also is assumed that resources under the jurisdiction of other agencies will be treated in a manner compatible with existing statutes and regulations. This agreement will

specify preparation of a comprehensive Cultural Resources Management Plan (CRMP) for the Peacekeeper project. The plan will specify appropriate maintenance,, rehabilitation, restoration, or reconstruction treatments of historic properties to be applied within the mission and budgetary constraints of the Air Force, and will include the following features:

- Procedures for inventorying all cultural resources that potentially will be directly affected by the Proposed Action;
- Procedures for evaluating cultural resources for National Register eligibility in accordance with criteria established in 36 CFR 60.6;
- Procedures for monitoring project construction to insure against loss of previously unrecorded resources that may be encountered during ground-disturbing activities;
- Procedures for long-term monitoring of known resources under Air Force control to insure maintenance of resource integrity;
- Procedures and guidelines for short and long-term curation of specimens and records resulting from all studies and investigations;
- Procedures for allocating resources to particular use categories (e.g., data recovery, interpretation, preservation in place);
- Resource-specific measures to restore, rehabilitate, reconstruct, retain, or recover important cultural properties that will be impacted directly by the Proposed Action; and
- Procedures for implementing, coordinating, and monitoring all action elements included within the management plan.

Two major categories of physical properties are included within cultural resources: 1) below-ground resources (e.g., archaeological sites) subject to impacts from ground disturbing construction activities; and 2) above-ground resources (e.g., historic structures and buildings) subject to impacts from facilities construction and modifications. Depending upon which category of resource is being considered, the resource-specific mitigations entailed by the PMOA and accompanying CRMP will vary accordingly.

For below-ground or archaeological resources, the Air Force will develop and implement the following mitigation measures:

- Avoid, where possible and practical, adverse impacts by facility redesign or engineering techniques;
- Stabilize, in whole or in part, effected National Register listed or eligible archaeological resources that can be preserved in whole or in part;
- Recover, analyze, evaluate, report, and provide curation for data from all National Register-eligible sites disturbed or destroyed by construction activities;

- Provide access to records and samples recovered as a consequence of mitigation studies for use in scientific research; and

- Ensure that unrecorded, buried resources are afforded timely and appropriate evaluation and mitigation measures as part of a construction monitoring program.

These mitigation measures have been incorporated into the current analysis of impacts. Although they have little overall effect on the level of impacts associated with the project, these measures do have important consequences for assessments of impact significance. Full implementation of assumed mitigations will make project-caused impacts to archaeological properties not significant.

For above-ground or architectural resources, mitigation of project-caused impacts will occur largely as part of the facilities design process. In this regard, the Air Force will develop and implement resource-specific measures within operational and budgetary constraints that specify appropriate inspection, maintenance, preservation, rehabilitation, and restoration treatments for buildings in accordance with the Secretary of the Interior's Standards for Historic Preservation Projects. These will expand upon the following Air Force commitments:

- Functionally adaptive and compatible reuse of historic buildings within the District/Landmark will be considered before other siting alternatives.

- New construction within the District/Landmark will be designed to be compatible architecturally with the existing historic environment as to siting, scale, mass, detail, material, texture, and color.

- Alterations and additions to existing structures within the District/Landmark will be designed using the design vocabulary of the structure being altered or added to, and sited so as to minimize intrusion on the District/Landmark as a whole.

- New construction outside the District/Landmark will be designed and sited to avoid or minimize intrusions on the District/Landmark.

Under the management plan for each project element impinging upon important architectural resources, a series of specific mitigation measures will be incorporated into the design criteria for that program element. These design criteria will be made a part of the Installation Planning and Design Guide for F.E. Warren AFB, which incorporates mitigations to environmental impacts in the design of the project and provides continuing guidance for construction at F.E. Warren AFB.

The program of mitigations outlined above for historic architectural resources conditions the current analysis, reducing both the level and significance of impacts. Indeed, implementation of the specific mitigation measures to be incorporated into the design guide will result in a net beneficial effect on this resource element. Circumstances may arise, however, in which facilities requirements may conflict with the historic preservation management objectives that have been developed for a particular resource. In such situations, it is

possible that one or more building-specific mitigation measures may not be feasible and that significant impacts will result. The current analysis recognizes this and has incorporated its consequences into project impact determinations.

3.4.3 Environmental Consequences of the Proposed Action and No Action Alternative

The sections that follow summarize impacts to cultural and paleontological resources associated with the various actions entailed by Peacekeeper deployment and peacetime operations. In the case of all resource elements, these discussions are preceded by a consideration of "baseline future" conditions and changes. These examinations of future trends in the resource in the absence of the project (the "No Action Alternative") provide the framework within which project impacts may be understood.

In instances where an assessment of impacts to specific sites is not possible, consideration of cultural and paleontological resources must be based on an understanding of the overall impacts now occurring or expected to occur within the ROI. Studies performed for other resources (e.g., geology, land use) as part of the current environmental assessment program can be used to deduce the level of environmental change that can be expected to occur both with and without the project. In general, changes affecting land surfaces, area use patterns, and population are most likely to impact cultural and paleontological resources. Included among such baseline changes are:

- Increased population density and altered spatial dispersion;
- Increased recreational activities and altered patterns;
- Expansion or modification of energy transmission and transportation corridor networks;
- Development of new housing and commercial structures;
- Development/expansion of mineral extraction operations and water storage and transport; and
- Changes in land ownership (e.g., from state to private control).

These changes, if not mitigated, could affect adversely the content and contexts of cultural and paleontological properties by increasing human traffic (e.g., hunters, hikers, ORV users, construction workers, sightseers) in the vicinity of sites by introducing operations or activities that disturb surface and subsurface deposits (e.g., construction of roads, dams, tracts, and transmission lines; surface grading; reduction of surface vegetation; mining) or by modifying existing legislated management or protection measures.

As noted previously, the analysis of impacts to cultural and paleontological resources involved projecting known and anticipated project requirements onto baseline future conditions to establish the nature of resultant changes (Tables 3.4.3-1). In addition, assumed mitigations, which primarily affect impact significance, were overlayed onto these baseline changes to determine the net impact of the project. For most project elements, implementation of

Table 3.4.3-1

PROJECT-CAUSED BASELINE CHANGES TO PREHISTORIC AND HISTORIC CULTURAL RESOURCES IN THE AREA OF CONCENTRATED STUDY

Project Element	Requirements	Baseline Changes
Facility Construction		
Launch Facility Modifications, Quantity Distances, and Access Roads	Modifications to accept Peacekeeper missile and upgrading of access roads and maneuvering areas for stage/transporter	Extending the Quantity Distance, and widening and upgrading of access roads affecting historic and prehistoric sites
Add/Alter Energy Management Control System	Tie project facilities into Base Energy Management Control System	Installation of equipment and trenching affecting historic and prehistoric resources
Add/Alter Missile Maintenance Shops	Accommodations for Peacekeeper equipment maintenance and corrosion control facility	Additions and alterations affecting historic resources (Historic District/Landmark and Bldg. 336)
Add/Alter Missile Support Facility	Space for missile guidance control system, maintenance and storage, and space for vehicle and equipment control branch	Additions and Alterations affecting historic resources (Historic District/Landmark and Bldg. 332)
Alter Communication Maintenance Facility	Space for communication equipment	Alteration affecting Bldg. 1250
Alter Missile Maintenance Support Facility	Office space for technical personnel	Alteration affecting historic resource (Bldg. 340)
Alter Security Control Center	Increase space for Wing Security Control and consolidate Security Police functions	Alteration affecting historic resource (Bldg. 34)
Heating Distribution Lines	Supply heat to Peacekeeper facilities	Trenching and other ground disturbance affecting prehistoric and historic resources
Integrated Support Complex	Temporary warehousing and office space for contractors and SATAF	New construction indirectly affecting historic resources (Bldgs. 801-806)
Launch Facility Trainer (Silo)	Training for missile maintenance personnel	New construction affecting Historic District/Landmark

Table 3.4.3-1, Continued, Page 2 of 2
PROJECT-CAUSED BASELINE CHANGES

Project Element	Requirements	Baseline Changes
Facility Construction, cont.		
Miscellaneous Facility Alterations	Administration space for SATAF personnel	Modifications and alterations affecting historic resources (Bldgs. 152, 250, 330, 389)
Contractor Support Area Shops	Space for contractor equipment maintenance and repair	New construction affecting prehistoric and historic resources
Trainer and Instruction Facility	Training for missile maintenance personnel	New construction affecting Historic District/Landmark
Utilities: Sewage/ Water	Water supply and sewage disposal for Peacekeeper facilities	Trenching and other ground disturbance affecting prehistoric and historic resources
Utilities: Power	Electrical power supply to Peacekeeper facilities	Trenching and other ground disturbance affecting prehistoric and historic resources
Stage Storage Area	Storage and handling of missile stages and special vehicle maintenance	New construction and other ground disturbing activities
Weapons Storage Area	Assembly and storage of Reentry Systems	New construction and other ground disturbing activities
Stage Transporter Routes		
Defense Access Roads	Stage transporter transportation network to Launch Facilities	Widening and upgrading of road surfaces and structures affecting prehistoric and historic resources
Onbase Roads	Access to and between onbase Peacekeeper facilities and egress from base	New construction and upgrading of existing roads affecting Historic District/Landmark and historic and prehistoric archaeological resources
Dispatch Stations	Contractor field storage and office space	Undetermined
Cable Paths	Command control and communication between missile flights	Trenching and other ground disturbances affecting prehistoric resources

assumed mitigations identified in Section 3.4.2 will prevent significant impacts to cultural and paleontological resources, and a "not significant" impact rating results. Where these mitigations cannot be wholly implemented and NRHP-eligible or listed resources are affected, however, impacts have been rated as significant for that project element.

3.4.3.1 Prehistoric Cultural Resources

3.4.3.1.1 Baseline Future - No Action Alternative.

Nonproject-related changes to prehistoric cultural resources within the ROI and ACS will occur from a variety of natural and manmade causes. Although most trends mentioned here will result in an overall loss of resource values, certain actions may have beneficial effects.

One of the most important sources of degradation to the existing resource base is the ongoing natural erosion/decay that affects all physical properties exposed to the environment. This process is expected to continue into the future at a fairly uniform rate, and over the long term, will significantly diminish the scientific and/or humanistic value of the resource.

Both short and long-term degradation of the resource also will result from current and projected regional land use patterns. Housing construction, industrial and urban development, recreational use, agricultural practices, and the like all may contribute to the loss of scientific and humanistic values. Population projections indicate that increases can be expected in the number of people inhabiting the region during the coming years, and therefore, resource sites likely will be altered or destroyed at an increasing rate.

Ongoing and proposed construction of new facilities and modifications to existing structures at F.E. Warren AFB for non-Peacekeeper activities could cause loss of both known and unknown prehistoric resources. A recently completed archaeological inventory of selected portions of the base recorded 24 prehistoric sites within a relatively small area; therefore, it is concluded that virtually any onbase ground-disturbing activity has the potential for disturbing additional prehistoric cultural deposits.

3.4.3.1.2 Proposed Action

Direct project impacts affecting important prehistoric cultural resources will occur as a result of several ground-disturbing activities required by the assembly, deployment, and operation of the Peacekeeper missile system (Table 3.4.3-2). In the paragraphs that follow, these impacts are described for each element of the project.

Construction of support facilities at F.E. Warren AFB will result in low to moderate, short and long-term impacts to resources located in the immediate vicinity of anticipated construction sites. Proposed onbase facilities construction will involve some above-ground modifications to existing structures or new construction in areas that have witnessed prior disturbance, and negligible impacts are expected from these activities. On the other hand, modification of a new Stage Storage Area (SSA), installation of below-ground utilities, and proposed additions to the Weapons Storage Area (WSA) will involve substantial new ground disturbance in areas that may contain

Table 3.4.3-2
DATA BASE FOR RATING LOI FOR PREHISTORIC RESOURCES

PROPOSED ACTION	DESCRIPTION OF ACTION	BASELINE DATA	NRHP STATUS[1]	DATA RELIABILITY	EXPECTED RESOURCES
Facilities Constr. (F.E. Warren)	New SSA;new WSA bldgs;new/modified bldgs in Hist. Distr; new heating ducts, comm.lines,6 sewer lines betw. SSA & Historic District	24 Sites	13E 5U 6NE	75% inventory; Limited testing data	Few
Facilities Constr. (LFs,LCFs)	Silo modifications; Extension of QD to 1750';new access gates;possible changes in access roads;restricted use of QDs	1 Site at P7; Sensitive areas within QDs	U	100% inventory of LFs and access roads	Few in Flights Q, S,T,A,B, C&D;Very few elsewhere
S/T Routes (DARs)	308 mi. of roads subject to widening and upgrade	11 recorded sites in vicinity; Existing ROWs intersect highly sensitive areas	2E; 7U; 2NE	<1% Inventory	Few in Flights Q, S,T,A,B, C&D;Very few elsewhere
S/T Routes(FE Warren)					
R1	SSA to Gate 5; WSA to Gate 2 via new roads	8 Sites	2E 3U 3NE	100% Inventory of Alignment	Very few
R2	SSA to Gate 5; SSA to WSA; WSA to Gate 2	22 Sites	12E 5U 5NE	100% Inventory of Alignment	Very few
R3	SSA to WSA to New Gate; SSA to Gate 5	14 Sites	10E 2U 2NE	100% Inventory of Alignment	Very few
Dispatch Stations					
Proposed	Temporary Bldgs, equip. storage areas (≈1ac) at FE Warren AFB, Chugwater, & Kimball	Locations to be determined; No surveys conducted	U	Site-specific Information Lacking	Few
Alternative	Temporary bldgs, equip. storage areas (≈1ac) at Kimball	Locations to be determined; No surveys conducted	U	Site-specific Information Lacking	Few
No Dispatch Stations	Some clerical staff in existing onbase bldgs.	N/A	N/A	High	None
Cable Paths					
PA1 (Proposed Action)	1.3mi/35'easement; 3' trench in existing ROW	No recorded sites;interfluve area	N/A	Not Inventoried	Few
SB1 (Proposed Action)	12mi/35'easement; 3' trench in existing ROW	2 recorded sites; Hawk Spr. Resv. Dry Creek	1E 1U	>50% Inventory ETSI 200'ROW	Few/Many Hawk Spr. area very sensitive

TABLE 3.4.3-2 Continued, page 2 of 2
DATA BASE FOR PREHISTORIC RESOURCES

PROPOSED ACTION	DESCRIPTION OF ACTION	BASELINE DATA	NRHP STATUS[1]	DATA RELIABILITY	EXPECTED RESOURCES
RB1 (Proposed Action)	25mi/35'easement; >6' trench along Horse Creek	No recorded sites; Horse & Bushnell Creeks	N/A	<1% Inventory	Few/Many Alluvial areas sensitive
PA4 (Proposed Action)	22mi/35'easement; >6' trenching; Align. transects Chivington & Antelope Draws	No recorded sites	N/A	<1% Inventory	Many in Drainages/Uplands; Few elsewhere
PA5 (Proposed Action)	24mi/35'easement; Extends S of Little Horse Ck to SW of Albin; Diverse terrain	1 recorded site	U	<1% Inventory	Few/Many along Breaks; Few elsewhere
PO1	28mi/35'easement; Horse Ck. drainage & breaks; >6' trenching	1 recorded site	U	<15% Inventory	Many in Drainage/Breaks along Horse Ck; Few elsewhere
PB1	20mi/35'easement; >6' trenching; Diverse terrain	3 recorded sites	1E 1NE 1U	<15% Inventory	Many in Uplands along Horse & Bushnell Ck.
PA3	14mi/35'easement; Horse Ck. drainage uplands,& interfluve areas	No recorded sites	N/A	<5% Inventory	Few/Many along drainages & breaks
PA2	13mi/35'easement; Crosses or abuts 4 drainages;dissected terrain;3-6'trenching	No recorded sites	N/A	<1% Inventory	Many-Drainages, dissected areas; Few elsewhere
RB2	14mi/35'easement; N of Horse Ck breaks in interfluves	No recorded sites	N/A	<1% Inventory	Few
SB2	26mi/35'easement; Very diverse terrain; >6' trenching	No recorded sites	N/A	<1% Inventory	Many near Table Mt.,Signal Butte, & drainages; Few elsewhere
Inmigrants	Baseline population increases in ROI; ≈500 net increase in AFB personnel over long term; increased recreation usage; altered land use	1271 recorded sites	4R 39E 55NE 1172U	<1% Inventory of ROI	Few Site-specific effects cannot be predicted

[1] R=Registered; E=Eligible; NE=Not Eligible; U=Unknown

unrecorded subsurface prehistoric sites. Nevertheless, an overall low LOI has been assigned to this aspect of the project because resource inventory did not identify any surface-evident remains in the siting areas, and a relatively low potential exists for finding extant subsurface cultural deposits within these particular portions of the base. Long-term cumulative impacts could occur in areas away from construction sites due to artifact collection by base personnel, but these are given an overall low LOI.

Construction activities associated with modifying existing Minuteman Launch Facilities (LFs) will result in negligible, short-term impacts to resources at the silos and in adjacent areas. The negligible impact rating is based on results of onsite reconnaissance of all proposed LFs. The inventory program recorded a single archaeological site in the vicinity of the silos. This site appears to have been greatly disturbed as a result of construction activities associated with Minuteman deployment. At the same time, areas adjacent to silos may contain important resources that could incur impacts if construction crews (short term) and security patrols (long term) engage in artifact collection or other actions that alter cultural associations. The LOI attributed to these actions is rated as negligible, however, because it is anticipated that most personnel will be required to confine their activities to areas within the existing fence at each silo.

Preliminary reconnaissance inventory of Defense Access Roads (DARs) requiring widening or upgrading indicates that a number of links are within archaeologically sensitive areas and may well intersect prehistoric sites. Therefore, construction-related disturbances could result in moderate, short-term impacts of long duration and low long-term impacts at the site level for the operation phase. Onsite inventory will be necessary to locate and evaluate resources subject to such impacts.

The proposed alternatives (R1, R2, and R3) for Stage Transporter (S/T) routes that would service F.E. Warren AFB are characterized by moderate to high, short-term impacts of long duration and low, long-term impacts at the site level. Previous onbase inventory identified several loci of prehistoric activity that might be affected by construction or by long-term artifact collection. One of the alternatives (R3) will affect fewer known resources than the other two and another (R2) traverses more areas that are archaeologically sensitive.

Anticipated impacts associated with any of the proposed construction dispatch stations alternatives will be low to negligible, depending upon the number and sizes of areas involved and project duration. Given that these facilities will be temporary structures used only during the deployment period, impacts mainly will be of short-term at each staging facility site. The F.E. Warren AFB - Chugwater - Kimball dispatch station option has a slightly higher LOI than the Kimball alternative; nowever, the difference is not great enough to warrant different LOI ratings. The No Dispatch Station alternative will have a negligible impact on the resource.

Eleven alternative paths have been proposed for the buried cable system that will cross-link the system's LFs. Five of these rights-of-way ultimately will be selected for installation. All of the 11 alternatives consist of 1-mile wide corridors within which a particular 35-foot easement will be chosen, and two alignments (PA1 and SB1) have existing cable. All eleven corridors pass

close to known sites or through archaeologically sensitive areas (e.g., flood plains and terraces). Given that installation will involve digging trenches along prescribed rights-of-way, severe localized disturbances will occur at any intersected resources. In view of these characteristics, moderate to high, short-term impacts of long duration will result from for all proposed alternatives except PA1, which is rated as low. Overall, the Proposed Action has a higher aggregate LOI than the alternative paths.

Low, short-term impacts of long duration are anticipated at the regional level as a consequence of project-induced population increases and altered land use. In addition, low, long-term impacts are expected at the site and regional levels. The kinds of impacts resulting from these indirect changes will parallel those already described in Section 3.4.3.1.1.

3.4.3.2 American Indian Cultural Resources

3.4.3.2.1 Baseline Future - No Action Alternative

American Indian cultural resources that may exist within the ROI and ACS have been and will continue to be affected by ongoing natural and cultural processes that alter the landscape. Because these are similar to those impinging upon other types of cultural resources (e.g., erosion and land surface degradation, removal or alteration of natural vegetation, increased human use of the land, expansion of existing metropolitan areas), it is expected that alteration of American Indian resources will occur in the future at a rate proportional to projected baseline changes described for the other cultural resource elements (see Sections 3.4.3.1.1 and 3.4.3.3.1).

3.4.3.2.2 Proposed Action

Impacts affecting important American Indian cultural resources may occur as a consequence of several activities involved in the assembly, deployment, and operation of the Peacekeeper missile system (Table 3.4.3-3). These impacts are described for each major component of the project.

Neither F.E. Warren AFB nor the Deployment Area (DA) is known to contain American Indian cultural resources. Nevertheless, the possibility of such resources being present does exist, particularly in the vicinity of the proposed cable paths. Consequently, negligible to low LOIs have been assigned to activities associated with construction of project facilities and system operations. In the event that such resources are encountered during construction or operations, representatives of potentially interested American Indian groups will be contacted to solicit their evaluations of resource importance and the need for impact mitigation.

3.4.3.3 Historic Cultural Resources

3.4.3.3.1 Baseline Future - No Action Alternative

Even in the absence of the Proposed Action, future loss of historic cultural resources will occur as a consequence of various natural and cultural factors. Although most of these anticipated changes will be detrimental to scientific and humanistic values, certain actions also may be beneficial.

TABLE 3.4.3-3
DATA BASE FOR RATING LOI FOR AMERICAN INDIAN RESOURCES

PROPOSED ACTION	DESCRIPTION OF ACTION	BASELINE DATA	NRHP/AIRFA STATUS[1]	DATA RELIABILITY	EXPECTED RESOURCES
Facilities Constr. (F.E. Warren)	New SSA;new WSA bldgs;new/modified bldgs in Hist. Distr; new heating ducts, comm.lines, & sewer lines betw. SSA & Historic District	No recorded sites	N/A	100% Inventory	None
Facilities Constr. (LFs,LCCs,LCFs)	Silo modifications; Extension of QD to 1750';new access gates;possible changes in access roads;restricted use of QDs	No recorded sites	N/A	100% Inventory of Lfs and access roads	Very few
S/T Routes (DARs)	308 mi. of roads subject to widening and upgrade	No recorded sites	N/A	Site-Specific Information Lacking	Very few
S/T Routes(FE Warren)					
R1	SSA to Gate 5; WSA to Gate 2 via new roads	No recorded sites	U	100% Inventory	None
R2	SSA to Gate 5; SSA to WSA; WSA to Gate 2	No recorded sites	N/A	100% Inventory	None
R3	SSA to WSA to New Gate; SSA to Gate 5	No recorded sites	N/A	100% Inventory	None
Dispatch Stations					
Proposed	Temporary bldgs, equip. storage areas (≈1ac) at FE Warren AFB, Chugwater,Kimball	No recorded sites	N/A	Site-Specific Information Lacking	Very few
Alternative	Temporary bldgs, equip. storage areas (≈1ac) at Kimball	No recorded	N/A	Site-Specific Information Lacking	Very few
No Staging Areas	Some clerical staff in existing onbase bldgs.	N/A	N/A	High	None
Cable Paths					
PA1 (Proposed Action)	1.3mi/35'easement; 3' trench in existing ROW	No recorded sites	N/A	Not Inventoried	Very few
SB1 (Proposed Action)	12mi/35'easement; 3' trench in existing ROW	No recorded sites	N/A	Not Inventoried	Very Few
RB1 (Proposed Action)	25mi/35'easement; >6' trench along Horse Creek	No recorded sites	N/A	Not Inventoried	Very few

TABLE 3.4.3-3 Continued, page 2 of 2
DATA BASE FOR AMERICAN INDIAN RESOURCES

PROPOSED ACTION	DESCRIPTION OF ACTION	BASELINE DATA	NRHP/AIRFA STATUS[1]	DATA RELIABILITY	EXPECTED RESOURCES
PA4 (Proposed Action)	22mi/35'easement; >6' trenching; Align. transects Chivington & Antelope Draws	No recorded sites	N/A	Not Inventoried	Very few
PA5 (Proposed Action)	24mi/35'easement Extends S of Little Horse Ck to SW of Albin; Diverse terrain	No recorded sites	N/A	Not Inventoried	Very few
P01	28mi/35'easement; Horse Cr. drainage & breaks; >6' trenching	No recorded sites;Proto-historic sites in vicinity	N/A	Not Inventoried	Very few
PB1	20mi/35'easement; >6' trenching; Diverse terrain	No recorded sites;Proto-historic sites in vicinity	N/A	Not Inventoried	Very few
PA3	14mi/35'easement; Horse Cr. drainage, uplands & interfluvial areas	No recorded sites;Proto-historic sites in vicinty	N/A	Not Inventoried	Very few;area extensively used over time
PA2	13mi/35'easement; Crosses or abuts 4 drainages;dissected terrain;3-6'trenching	No recorded sites	N/A	Not Inventoried	Very few
RB2	14mi/35'easement; N of Horse Ck breaks in interfluve	No recorded sites	N/A	Not Inventoried	Very few
SB2	26mi/35'easement; Very diverse terrain; >6' trenching	No recorded sites;Scotts Bluff & Signal Butte important to Sioux, Cheyenne, etc.	N/A	Not Inventoried	Very few;Scotts Bluff area may be sensitive
Immigrants	Baseline population increases in ROI; ≈500 net increase in AFB personnel over long term; increased recreation usage; altered land use	No recorded sites	N/A	Site-Specific Information Lacking	Very few

[1] R=Registered; E=Eligible; NE=Not Eligible; U=Unknown

Long-term loss of resource integrity will occur throughout the ROI and ACS as a consequence of natural agencies such as erosion and decay, depending upon resource location (e.g., proximity to active erosion areas along watercourses) and current condition. Unattended and abandoned structures or sites will suffer greater degradation than those that are occupied or managed.

Long and short-term changes attributable to human agency are likely to be greater than those due to natural causes. Current rural and urban land use practices and anticipated future changes in regional demographics will exert a variety of effects on baseline conditions. For example, increasing regional population will be accompanied by greater use of existing recreational areas and a demand for additional facilities. Where such increased public access and use occurs and associated cultural sites are not under management, the resource base will incur cumulative long-term losses.

Rural areas contain historic resources that reflect different cultural themes than those in urban areas. Structures tend to represent developmental trends in agricultural and ranching architecture or land use patterns. Most are situated on private lands that are subject to county ordinances and tend to lack the emotional appeal of urban structures. Funding for preservation programs is difficult to obtain, and protection from vandals and collectors often is minimal. The general decline in farming within the region has resulted, and will continue to result, in increased abandonment of farm houses and outbuildings that may have historic importance.

Known historic resources located within the region's cities and towns generally are standing structures. Although vulnerable to modification and/or destruction as a result of urban renewal programs, fire, vandalism, pollution, and urban blight, these resources also tend to have high visibility and often have been accorded some measure of protection through a variety of management programs ranging from tax incentives and block grants for restoration to municipal zoning variances. Several communities in the region (e.g., Cheyenne, Torrington, Greeley, Fort Collins) have taken active measures to identify and protect historic properties within their jurisdictions, and this trend is expected to gain further momentum in the future.

The F.E. Warren Historic District/National Landmark, encompassing approximately 200 individual historic structures, will continue to be used as a military installation and will be subject to potential modifications from new construction, adaptive reuse of existing structures, and ongoing maintenance. Such changes will have important short and long-term consequences for the District/Landmark's integrity.

3.4.3.3.2 *Proposed Action*

Direct project impacts affecting important historic cultural resources will occur as a result of several of the activities involved in the assembly, deployment, and operation of the Peacekeeper system (Table 3.4.3-4). Given that anticipated impacts to historic resources generally parallel those noted in discussions of the prehistoric resource element, treatment here is briefer and emphasizes those aspects of the Proposed Action that would have measurable net effects on existing baseline conditions.

TABLE 3.4.3-4
DATA BASE FOR RATING LOI FOR HISTORIC RESOURCES

PROPOSED ACTION	DESCRIPTION OF ACTION	BASELINE DATA	NRHP STATUS[1]	DATA RELIABILITY	EXPECTED RESOURCES
Facilities Constr. (F.E. Warren)	New SSA;new WSA bldgs;new/modified bldgs in Hist. Distr; new heating ducts, comm.lines & sewer lines betw. SSA & Historic District	Buried remains & standing structures on base as a whole; 18 recorded sites & ≈300 buildings	1R 10E 5U 3NE	100% Inventory of surface area;all bldgs. recorded on inventory	Few; additional subsurface sites expected
Facilities Constr. (LFs,LCCs,LCFs)	Silo modifications; Extension of QD to 1750';new access gates;possible changes in access roads;restricted use of QDs	All LFs surveyed; Visual survey of QDs	4U	Only areas <25' of LFs inventoried at close range; QDs inventoried at a distance	Few; additional sites may be found
S/T Routes (DARs)	308 mi. of roads subject to widening and upgrade	≈200mi of links include adjacent historic bldgs.	>50U 2E	Windshield survey only	Few; additional sites may occur along ROW
S/T Routes					
R1	SSA to Gate 5; WSA to Gate 2 via new roads	No bldgs along proposed ROW; 6 recorded sites	3E 2U 1NE	100% Inventory along ROW	Very few
R2	SSA to Gate 5; SSA to WSA; WSA to Gate 2	No bldgs along proposed ROW; 18 recorded sites	12E 3U 3NE	100% Inventory along ROW	Ver few
R3	SSA to WSA to New Gate; SSA to Gate 5	No bldgs along proposed ROW; 12 recorded sites	9E 1U 2NE	100% Inventory along ROW	Very few
Dispatch Stations					
Proposed	Temporary bldgs; equip. storage areas (≈1ac) at FE Warren AFB, Chugwater & Kimball	Locations to be determined; Historic Bldgs. in vicinity of all proposed areas	U	Site-Specific Information Lacking	Few
Alternative	Temporary bldgs; equip. storage areas (≈1ac) at Kimball	Locations to be determined; Historic Bldgs. in vicinity of all proposed areas	U	Site-Specific Information Lacking	Few
No Staging Areas	Some clerical staff in existing onbase bldgs.	Locations to be determined; Historic Bldgs.	U	Site-Specific Information Lacking	None
Cable Paths					
PA1 (Proposed Action)	1.3mi/35'easement; 3' Trench in Existing ROW	No Recorded Sites	N/A	Not Inventoried	Few; Possible early farming/ranching activities
SB1 (Proposed Action)	12mi/35'easement; 3' trench in existing ROW	Historic Bldg; Cheyenne-Red Cloud & Cheyenne-White Clay Trails	1R 1U	<50% Inventory	Few/Many Hawk Springs & Dry Cr. very sensitive

TABLE 3.4.3-4 Continued, page 2 of 2
DATA BASE FOR HISTORIC RESOURCES

PROPOSED ACTION	DESCRIPTION OF ACTION	BASELINE DATA	NRHP STATUS[1]	DATA RELIABILITY	EXPECTED RESOURCES
RB1 (Proposed Action)	25mi/35'easement; >6' trench along Horse Creek	Irwin & Donahue Ranches Cheyenne-Red Cloud Tr;Texas Tr; historic sod house	1U 1E	<1% Inventory	Few/Many; Transects areas of early ranching & homesteading
PA4 (Proposed Action)	22mi/35'easement >6' crenching; Align. transects Chivington & Antelope Draws	Cheyenne-Red Cloud Tr; Hicks Cemetery	U	<1% Inventory	Few; Transects areas of early ranching & homesteading
PA5 (Proposed Action)	24mi/35'easement Extends S of Little Horse Ck to SW of Albin; Diverse terrain	1 recorded site	U	<1% Inventory	Few/Many along or near breaks,water sources;Very few elsewhere
PD1	28mi/35'easement; Horse Cr. drainage & breaks; >6' trenching	Little Horse Cr. Ranch;6 historic bldgs in Albin; Texas Trail	U	<15% Inventory	Few; Transects areas of early ranching & homesteading
PB1	20mi/35'easement; >6' trenching; Diverse terrain	Little Horse Cr. Ranch;McMann,Jones Homesteads;Texas Tr;Cheyenne-Red Cloud Trail	1E U	<15% Inventory	Many; Transects areas of early ranching & homesteading
PA3	14mi/35'easement; Horse Cr. drainage, uplands & inter-fluvial areas	Little Horse Cr. Ranch;Cheyenne-Red Cloud Trail	U	<5% Inventory	Few; Transects areas of early ranching
PA2	13mi/35'easement; Crossses or abuts 4 drainages; Dissected terrain 3-6' trenching	Cheyenne-Red Cloud Tr;Touns Homestead; Spaatz Ranch	U	<1% Inventory	Few; Transects areas of early ranching & settlement
RB2	14mi/35'easement; N of Horse Ck breaks in interfluves	No recorded sites	N/A	<1% Inventory	Few; Transects areas of early ranching
SB2	26mi/35'easement; Very diverse terrain; >6' Trenching	Cheyenne-Red Cloud Trail;Texas Trail; Table Mt. School; Crockett Ranch; Campbell Ranch	U	<1% Inventory	Few/Many; Transects areas of early ranching & settlement
Immigrants	Baseline population increases in ROI; ≈500 net increase in AFB personnel over long term;increased recreation usage; altered land use	1151 Recorded Sites	68R 136E 17NE 930U	<1% Inventory	Few; Resources prone to collection

[1] R=Registered; E=Eligible; NE=Not Eligible; U=Unknown

Construction of support facilities at F.E. Warren AFB and activities associated with modifying Minuteman LFs for project operations are expected to result in moderate to high, short-term impacts of long duration to resources located within areas of proposed construction. At F.E. Warren AFB, project-related modifications to historic structures necessary to provide support facilities for project operations will affect interior and exterior characteristics of buildings currently included in the F.E. Warren Historic District/National Landmark. In addition, there is a high likelihood of encountering subsurface historic archaeological remains along proposed utility corridors servicing project facilities. Consequently, significant, moderate, short-term impacts of long duration and low, long-term impacts are expected at the site level.

Offbase structures within the ACS may incur direct or indirect impacts, but it is anticipated that project requirements will not require removal or alteration of the overwhelming majority of such structures. Consequently, impacts are rated low at the site level over both the short and long terms.

The proposed alternatives (R1, R2, and R3) for S/T routes servicing F.E. Warren AFB are characterized by moderate to high, short-term impacts of long duration and low, long-term impacts at the site level. Although none of the alternatives will directly impact existing historic structures, as currently sited the proposed routes will intersect surface or subsurface historic archaeological remains.

Anticipated impacts associated with any of the proposed construction dispatch station alternatives will be negligible or low. It is anticipated that such areas will not require removal or alteration of any standing structures, and impacts to historic archaeological sites at any of the proposed dispatch stations, including F.E. Warren AFB, will be minimal.

Moderate, short-term impacts of long duration and low, long-term impacts at the site level could occur along all but two of the proposed buried cable paths. Such estimates are based both on the presence of recorded historic structures in the immediate vicinity of the paths and on the lack of prior systematic inventories identifying existing resources in these areas. Among the alternatives, the highest LOI is expected to be associated with route PB1, where recorded sites are most numerous. Current data are not adequate to distinguish important differences among the altervatives, and accordingly, both the proposed and the alternatives are assigned moderate LOI ratings.

Low, indirect, short and long-term population-induced impacts are anticipated at the regional level. These impacts are likely to result from modifications to existing historic structures that could effect resource integrity. Increased population levels are likely to be accompanied by increased disturbance of archaeological sites and abandoned historic structures. Low, long-term impacts also are expected at the site level.

3.4.3.4 Paleontological Resources

3.4.3.4.1 Baseline Future - No Action Alternative

Paleontological localities are slightly less sensitive to impacts from natural and cultural agencies than are cultural resources. Natural processes (e.g., erosion) and man-made disturbances (e.g., road construction) currently are exposing fossiliferous deposits throughout the ROI, allowing access by amateur and professional collectors as well as increasing the overall loss of potential baseline data. These activities are expected to continue in the future at much the same rate as at present and will result in cumulative loss of the resource. Some localities (e.g., Como Bluff and Scotts Bluff) are afforded protection, but most are not. Throughout large areas of southeast Wyoming and western Nebraska, where dissected terrain is extensive, exposures of Ogallala, Arikaree, White River, and other potentially important formations provide not only opportunities for collection, but also source materials for construction. Future loss of the resource from the latter use should continue at approximately the same levels as occur currently.

3.4.3.4.2 Proposed Action

Direct project impacts affecting important paleontological resources may occur as a result of many of the activities involved in the assembly, deployment, and operation of the Peacekeeper system (Table 3.4.3-5). In the paragraphs that follow, these impacts are described for each major element of the Proposed Action.

Short-term, low impacts of long duration are projected for onbase construction activities. This assessment is based on the possibility that Quaternary and Pliocene age fauna, which may be expected to occur in exposures along Crow Creek in the immediate vicinity of Cheyenne, may exist onbase. If such remains are present, impacts could be expected as a consequence of any intensive landscape-altering activities. Negligible, short and long-term impacts are anticipated in association with modification of the LFs, because proposed facilities changes will involve minor ground disturbance.

The proposed alternatives (R1, R2, and R3) for S/T routes that would service F.E. Warren AFB are characterized by low, short-term LOIs of long duration at the site level. Despite its routing across streambeds and terraces where resource localities may be exposed near the surface, R2 has been assigned an LOI similar to that for R1 and R2. Because construction in all cases will be confined to a relatively narrow corridor, long-term impacts are rated negligible for all proposed alternatives.

Proposed modifications to offbase roads used to transport missile components to various LFs could affect important fossil deposits, particularly in the vicinity of Missile Flights B, S, and T. Elsewhere, impacts to fossiliferous Ogallala or Arikaree deposits could occur wherever road widening is anticipated for river crossings or along active or relict stream courses. Impact levels associated with these activities will be low over both the short and long term at the site level.

Given that proposed trenching for the buried cable paths could extend to depths of as much as 6 meters below the existing surface, fossil deposits

TABLE 3.4.3-5
DATA BASE FOR RATING LOI FOR PALEONTOLOGICAL RESOURCES

PROPOSED ACTION	DESCRIPTION OF ACTION	BASELINE DATA	SCIENTIFIC VALUE	DATA RELIABILITY	EXPECTED RESOURCES
Facilities Constr. (F.E. Warren)	New SSA;new WSA bldgs;new/modified bldgs in Hist. Distr; new heating ducts, comn.lines & sewer lines betw. SSA & Historic District	Ogallala Fm. outcrops along Crow Cr. in areas adjacent to Base	Low	100% Inventory	None
Facilities Constr. (LFs,LCCs,LCFs)	Silo modifications; Extension of QD to 1765';new access gates;possible changes in access roads;restricted use of QDs	Ogallala Fm. widespread; some Arikaree	Moderate	100% inventory of LFs and access roads	Very few; Actions will not disturb localities
S/T Routes (DARs)	308 mi. of roads subject to widening and upgrade	Ogallala, Arikaree,White River exposed in drainages; some Morrison	Moderate	<1% Inventory	Few; Road modif. could affect localities
S/T Routes(FE Warren)					
R1	SSA to Gate 5; WSA to Gate 2 via new roads	Crow Cr. potentially fossiliferous	Low	100% Inventory	None
R2	SSA to Gate 5; SSA to WSA; WSA to Gate 2	Crow Cr. potentially fossiliferous	Low	100% Inventory	None
R3	SSA to WSA to New Gate; SSA to Gate 5	Crow Cr. potentially fossiliferous	Low	100% Inventory	None
Dispatch Stations					
Proposed	Temporary bldgs, equip. storage areas (=1ac) at FE Warren AFB, Chugwater & Kimball	Crow Cr. potentially fossiliferous	Low	Site-specific Information Lacking	Very few
Alternative	Temporary bldgs, equip. storage areas (=1ac) at Kimball	Crow Cr. potentially fossiliferous	Low	Site-specific Information Lacking	Very few
No Staging Areas	Some clerical staff in existing bldgs. on Base	Crow Cr. potentially fossiliferous	Low	High	None
Cable Paths					
PA1 (Proposed Action)	1.3mi/35'easement; 3' trench in existing ROW	No major exposures	Low	Not Inventoried	Very few
SB1 (Proposed Action)	12mi/35'easement; 3' trench in existing ROW	Known fossil locality; Follows Dry Cr.	Moderate	<25% Inventory	Few; Trenching could affect fossil localities

TABLE 3.4.3-5 Continued, page 2 of 2
DATA BASE FOR PALEONTOLOGICAL RESOURCES

PROPOSED ACTION	DESCRIPTION OF ACTION	BASELINE DATA	SCIENTIFIC VALUE	DATA RELIABILITY	EXPECTED RESOURCES
RB1 (Proposed Action)	25mi/35'easement; >6' trench along Horse Creek	Ogallala, White River & Arikaree along Horse Cr. & breaks	Moderate	<1% Inventory	Few; Trenching could affect fossil localities
PA4 (Proposed Action)	22mi/35'easement; >6' trenching; Align. transects Chivington & Antelope draws	Dissected area w/ Ogallala & White River Fm. exposures	Low/ Moderate	<1% Inventory	Very few;Deep trenching could affect fossil localities
PA5 (Proposed Action)	24mi/35'easement Extends S of Little Horse Ck to SW of Albin; Diverse terrain	Exposures of Ogallala & Arikaree along Horse Cr. & breaks	Low/ Moderate	<1% Inventory	Few; High relief areas likely to contain fossils
PO1	28mi/35'easement; Horse Cr. drainage & breaks; >6' trenching	Exposures of Ogallala & Arikaree along Horse Cr. & breaks	Low/ Moderate	<1% Inventory	Few; High relief areas likely to contain fossils
PB1	20mi/35'easement; >6' trenching; Diverse terrain	Exposures of Ogallala & Arikaree along Horse Cr. & Breaks	Low/ Moderate	<1% Inventory	Few; High relief areas likely to contain fossils
PA3	14mi/35'easement; Horse Cr. drainage, uplands & inter-fluvial areas	Exposures of Ogallala & Arikaree along Horse Cr. & breaks	Low/ Moderate	<1% Survey	Very few;No recorded localities in area
PA2	13mi/35'easement; Crosses or abuts 4 drainages; Dissected terrain 3-6' trenching	Dissected area w/ Ogallala & White River Fm; no known localities	Low/ Moderate	<1% Survey	Very few; Exposures not extensive
RB2	14mi/35'easement; N of Horse Cr. breaks in interfluves	Exposures of Ogallala & Arikaree along Horse Cr. & Breaks	Low/ Moderate	<1% Inventory	Few; High relief areas likely to contain fossils
SB2	26mi/35'easement; Very diverse terrain; >6' trenching	Ogallala & Arikaree in Robb Draw; Wildcat Mt. is imp. Equus source	Low/ Moderate	<1% Survey	Very few
Immigrants	Baseline population increases in ROI; =500 net increase in AFB personnel over long term; increased recreation usage; altered land use	Recorded fossil localities throughout ROI	Low/ Moderate	<5% Survey	Very few/Few; Increased collection

could be encountered along any of the proposed alternative easements. Not all proposed paths have the same resource potential; proposed alternatives SB1 and RB1 have moderate, short-term LOI ratings due to their length and their siting at or near known fossil localities. All other cable paths, both proposed and alternative, have low, short-term LOIs at the site level. Long-term impacts are rated negligible for all paths.

No (or negligible) impacts are expected to occur as a consequence of any of the proposed dispatch station alternatives.

Because population-induced impacts to paleontological resources will be increased slightly over projected future trends without the Proposed Action, the short-term LOI will be negligible to low at both the regional and local levels. Nevertheless, even small losses or gains in scientific data may be meaningful in the long run, and long-term impacts are rated as low.

3.5 Summary of Impacts

Impacts to prehistoric and historic cultural and paleontological resources are summarized in Figures 3.5.1-1 to 3.5.1-3, wherein the overall impacts of the Proposed Action are presented in matrix format. The criteria for determining LOI and significance have been defined previously (Sections 3.2 and 3.3), applied to each of the proposed project elements, and evaluated according to both geographic scope and timing. These detailed assessments form the basis for establishing aggregate impact ratings for the resource as a whole.

3.5.1 Explanation of Detailed Impact Matrix

3.5.1.1 Prehistoric Cultural Resources

The rating for impacts to prehistoric cultural resources expected to occur as a consequence of the Proposed Action are shown in Figures 3.5.1-1 and 3.5.2-1. Separate consideration is given to the impacts of actions on the base and in the Deployment Area, which are treated within site-level ratings. Consequently, most impacts do not have a "local" effect. Local-level impact categorizations are reserved for effects occurring on a district-wide or municipality-wide basis.

Site-level, low, short-term impacts of long duration will result from onbase facilities construction and modification affecting prehistoric sites located in the immediate vicinity of proposed construction activities, and negligible impacts will occur in the long term due to project peacetime operations. Negligible impacts will occur as a consequence of modifications of existing Launch Facilities.

Moderate, short-term impacts of long duration will occur at the site level as a consequence of widening and upgrading Defense Access Roads because these activities will require new ground disturbance in areas expected to contain important prehistoric resources. Additional low, long-term impacts will occur as a consequence of increased access and altered local erosion characteristics affecting resources located immediately adjacent to road rights-of-way. The selection of either of the two resurfacing options for Defense Access Roads, however, will not change impact projections because such options will apply only to previously disturbed areas. Construction of onbase stage transporter

LEGEND		ADVERSE IMPACTS	SIGNIFICANT ADVERSE IMPACTS
LEVEL OF IMPACT*	LOW	○	●
	MODERATE	◯	●
	HIGH	◯	●
POTENTIAL BENEFICIAL EFFECTS			▒

* MEASURE OF THE AMOUNT OF ENVIRONMENTAL CHANGE

	PROJECT IMPACTS					
	SHORT TERM			LONG TERM		
	SITE	LOCAL	REGIONAL	SITE	LOCAL	REGIONAL
PREHISTORIC AGGREGATE IMPACT	◯			◯ [2]		
Facility Construction						
F.E. Warren AFB	○			○ [2]		
Launch Facilities						
Stage Transporter Routes						
Defense Access Roads	◯			◯ [2]		
F.E. Warren AFB						
Alternative R1	◯			◯ [2]		
Alternative R2	◯			◯ [2]		
Alternative R3	◯			◯ [2]		
Construction Dispatch Stations						
Proposed	○			○ [1]		
Alternative	○			○ [1]		
No Dispatch Stations						
Cable Paths						
Preferred	◯			◯ [1]		
Alternatives	◯			◯ [1]		
Population/Land Use Change (Indirect)			○	○		○ [1]

[1] Impacts are those generated by construction activities and having a long duration.

[2] Impacts are those generated by construction activities and having a long duration as well as those generated only by operational activities.

PREHISTORIC CULTURAL RESOURCES SUMMARY IMPACT MATRIX

FIGURE NO. 3.5.1-1

LEGEND		ADVERSE IMPACTS	SIGNIFICANT ADVERSE IMPACTS
LEVEL OF IMPACT*	LOW	○	●
	MODERATE	○	●
	HIGH	○	●
POTENTIAL BENEFICIAL EFFECTS		▒	

* MEASURE OF THE AMOUNT OF ENVIRONMENTAL CHANGE

	PROJECT IMPACTS					
	SHORT TERM			LONG TERM		
	SITE	LOCAL	REGIONAL	SITE	LOCAL	REGIONAL
HISTORIC AGGREGATE IMPACT	▒●			▒●[2]		
Facility Construction						
F.E. Warren AFB	▒●			▒●[2]		
Launch Facilities	○			○[2]		
Stage Transporter Routes						
Defense Access Roads	○			○[2]		
F.E. Warren AFB						
Alternative R1	○			○[2]		
Alternative R2	◯			◯[2]		
Alternative R3	○			○[2]		
Construction Dispatch Stations						
Proposed	○			○[1]		
Alternative	○			○[1]		
No Dispatch Stations						
Cable Paths						
Preferred	○			○[1]		
Alternatives	○			○[1]		
Population/Land Use Change (Indirect)			○	○		○[1]

[1] Impacts are those generated by construction activities and having a long duration.

[2] Impacts are those generated by construction activities and having a long duration as well as those generated only by operational activities.

HISTORIC CULTURAL RESOURCES SUMMARY IMPACT MATRIX

FIGURE NO. 3.5.1-2

LEGEND		ADVERSE IMPACTS	SIGNIFICANT ADVERSE IMPACTS
LEVEL OF IMPACT*	LOW	o	•
	MODERATE	○	●
	HIGH	◯	⬤
POTENTIAL BENEFICIAL EFFECTS			
* MEASURE OF THE AMOUNT OF ENVIRONMENTAL CHANGE			

	PROJECT IMPACTS					
	SHORT TERM			LONG TERM		
	SITE	LOCAL	REGIONAL	SITE	LOCAL	REGIONAL
PALEONTOLOGICAL AGGREGATE IMPACT	o			o[2]		
Facility Construction						
F.E. Warren AFB	o			o[1]		
Launch Facilities						
Stage Transporter Routes						
Defense Access Roads	o			o[2]		
F.E. Warren AFB						
Alternative R1	o			o[2]		
Alternative R2	o			o[2]		
Alternative R3	o			o[2]		
Construction Staging Areas						
Proposed						
Alternative						
No Staging Areas						
Cable Paths						
Preferred	o			o[1]		
Alternatives	o			o[1]		
Population/Land Use Change (Indirect)			o			o[1]

[1]Impacts are those generated by construction activities and having a long duration.

[2]Impacts are those generated by construction activities and having a long duration as well as those generated only by operational activities.

PALEONTOLOGICAL RESOURCES SUMMARY IMPACT MATRIX

FIGURE NO. 3.5.1-3

(S/T) routes will result in moderate to high, short-term impacts of long duration because proposed alignments intersect known important sites; additional low, long-term impacts will occur because of increased access and altered local erosion characteristics. While Alternative R2 has the greatest potential for both short and long-term impacts of the three major alternatives, selection of any of the design options that involve no new onbase road construction would reduce impact levels to negligible because choice of these options would not require any new ground disturbance affecting known prehistoric sites.

Low to negligible, short-term impacts of long duration will occur as a consequence of project dispatch station construction that could involve disturbance of prehistoric archaeological deposits. The "No Dispatch Station" option is preferable because the other proposed alternatives involve increased use of F.E. Warren AFB or outlying communities and the consequent risk of direct or indirect impacts to prehistoric sites.

Moderate to high, short-term impacts of long duration will result from installation of buried cable paths. Although most cable path options have high anticipated levels of impact because they traverse areas expected to contain abundant important prehistoric cultural materials, the Proposed Action will have less overall impact because paths PA1, RB1, and PA4 traverse areas expected to contain fewer such sites.

Low, short and long-term impacts will be generated regionally by population-induced and recreation-oriented activities involving increased artifact collecting and subsurface disturbance (e.g., construction of new housing).

3.5.1.2 American Indian Cultural Resources

Given that important American Indian cultural resources are not known to exist in the ACS, the project should have a negligible (or no) impact on the resource.

3.5.1.3 Historic Cultural Resources

The ratings for impacts to historic cultural resources expected to occur as a consequence of the Proposed Action are shown in Figure 3.5.1-2 and 3.5.2-1.

Significant, moderate, short-term impacts of long duration at the site level are expected to result from onbase facility construction and modification, particularly as they affect buildings within the Historic District/National Landmark. Additional significant, low, long-term impacts will occur as a consequence of project operations. At the same time, however, implementation of the types of specific mitigation measures discussed in Section 3.4.2 will result in a substantial net beneficial effect to historic architectural resources affected by the project, and adaptive reuse of facilities for project functions also should help prolong the useful life of these structures. Certain functional requirements of project facilities may not be accommodated within onbase historic buildings without loss of resource integrity. Consequently, impacts to onbase facilities are rated as significant in both the short and long term.

Widening and upgrading of Defense Access Roads will have low, short-term impacts of long duration due to the possibility of intersecting important historic archaeological deposits. Additional low, long-term impacts will result from increased access and altered local erosional characteristics. Selection of either of the two road resurfacing options will not affect these impact ratings. Construction of onbase stage transporter routes will result in moderate to high, short and long-term impacts because proposed alignments intersect several important historic archaeological sites; additional low, long-term impacts will occur because of increased access and altered local erosional characteristics. Alternative R2 has the greatest potential for both short and long-term impacts of the three major alternatives; however, selection of any of the design options that involve no new onbase road construction would reduce impact levels to negigible because they would not necessitate new ground disturbance that could affect important historic archaeological resources.

Negligible to low, short-term impacts of long duration will result from use of construction dispatch stations. The "No Dispatch Station" option is preferable because each of the other proposed alternatives involves increased use of F.E. Warren AFB or outlying communities and the consequent risk of direct or indirect impacts to historic structures and/or archaeological sites.

Activities associated with the installation of buried cables in the Deployment Area will result in moderate, short-term impacts of long duration because of the likelihood of path alignments intersecting important historic archaeological and architectural properties. Although most options have high anticipated LOIs, the Proposed Action will have less overall impact because paths PA1 and RB1 have a lower chance of intersecting important historic cultural resources.

Low, short and long-term impacts will be generated regionally by population-induced and recreation-oriented activities involving increased artifact collection, subsurface disturbance of historic archaeological deposits (e.g., construction of new housing), and alteration or demolition of historic structures.

3.5.1.4 Paleontological Resources

The ratings for impacts to paleontological resources expected to occur as a consequence of Peacekeeper Missile deployment are given in Figure 3.5.1-3. Low, short-term impacts of long duration and long term impacts are expected to occur at the site level from facilities construction, entrenchment of buried cables, and construction/upgrading of S/T routes on and offbase. Low regional impacts will occur as a result of project-induced population changes and altered land use. All other impacts from project elements are negligible.

3.5.1.5 Comparison of Alternatives

A summary comparison of the LOI rating for the various alternatives involved in the Proposed Action is given in Figure 3.5.1-4. Given that discussions in Section 3.4 have already considered impacts to individual resource elements as a consequence of each alternative, further treatment of this matter need not be provided here.

LEGEND

LEVEL OF IMPACT Measure of the Amount of Environmental Change	Adverse Impacts	Significant Adverse Impacts
Low	o	●
Moderate	○	●
High	◯	●
Potential Beneficial Effects	▒	

	Cable Paths[1]											Roads[2]			DISPATCH[3] STATIONS		
	Proposed Action					Alternatives											
	PA1	SB1	RB1	PA4	PA5	PD1	SB2	PB1	PA2	PA3	RB2	R1	R2	R3	Proposed	Alt.	None
CULTURAL RESOURCES	o	◯	◯	o	◯	◯	◯	◯	o	◯	o	o	◯	o	o	o	
Prehistoric Cultural	○	◯	◯	o	◯	◯	◯	◯	o	◯	o	o	◯	o	o	o	
Historic Cultural	o	○	◯	o	o	o	o	◯	o	o	o	o	◯	o	o	o	o
American Indian																	
Paleontological		○	○	o	o	○	o	o	o	o	o	o	o	o			

Notes: 1 Denotes specific cable paths. For location of cable paths see Section 1.6.3.3
2 For location of alternative routes see Section 1.6.2
3 For location of dispatch stations see Section 1.6.6

ALTERNATIVES COMPARISON MATRIX

FIGURE NO. 3.5.1-4

3.5.2 Aggregation of Elements, Impacts, and Significance

Aggregate impacts to cultural resources are expected to be moderate and significant in the short and long term at the site level, and negligible otherwise (Figure 3.5.2-1). Net beneficial effects may accrue from the implementation of assumed mitigation measures for potential impacts to buildings located within the F.E. Warren Historic District/National Landmark.

The aggregation of levels of impact and significance ratings from individual resource elements to the resource itself is accomplished by a two-step process. The following paragraphs explain the methods used in developing aggregate impact ratings as well as the results of applying such aggregation methods in the current assessment effort.

The first step involves combining impact ratings assigned to individual aspects of the Proposed Action (e.g., facilities construction at F.E. Warren AFB) to arrive at aggregate ratings for a resource element as a whole. Specification of element-level aggregate ratings involves assigning a summary measure that best reflects the overall LOI for the Proposed Action. This attribution is based on both professional experience and a judgmental qualitative weighting of level of impact ratings for the several individual components of Proposed Action; the various aspects of the project will have quite different kinds of impacts on any resources that may be subject to direct or indirect impact. For example, laying of proposed cable paths will result in intense, narrow, linear ground disturbances that will alter but probably not wholly destroy most resource sites intersected by an alignment. On the other hand, proposed facilities construction will affect broader areas, which could include entire sites. Consequently, the LOI rating for facilities construction carries more weight than that for cable paths.

Insofar as the current analysis is concerned, both prehistoric and historic cultural resources have the same element-level aggregate ratings (Figures 3.5.1-1 and 3.5.1-2): 1) moderate in the short term with long duration at the site-level, 2) low in the long term at the site-level, and 3) negligible otherwise. However, aggregate impacts to historic cultural resources are rated as significant because onbase facilities modifications could result in loss of important historic architectural values within the Historic District/National Landmark. Impacts to paleontological resources are rated low in the short term with long duration and low in the long term. Impacts to American Indian cultural resources will be negligible.

Once summary ratings have been established for a resource element, the second step in the process involves assigning aggregate LOI ratings to the resource as a whole. Given that no basis exists for differential weighting of prehistoric and historic cultural resource elements, aggregate impact determinations make use of equal-weighted averaging of the individual element-level ratings. For example, if high, short-term, site-level impacts are specified for prehistoric cultural resources and low impacts are specified for the historic cultural resource element, the overall short-term, site-level impacts to cultural resources will be rated moderate. In the current analysis, the element-level aggregate ratings for both prehistoric and historic cultural resources were identical (Figures 3.5.1-1 and 3.5.1-2), and, consequently, resource-level ratings were the same as the element-level ratings (Figure 3.5.2-1). Aggregate impacts are rated as significant because of the

LEGEND		ADVERSE IMPACTS	SIGNIFICANT ADVERSE IMPACTS
LEVEL OF IMPACT*	LOW	○	●
	MODERATE	○	●
	HIGH	◯	●
POTENTIAL BENEFICIAL EFFECTS			

* MEASURE OF THE AMOUNT OF ENVIRONMENTAL CHANGE

	PROJECT IMPACTS					
	SHORT TERM			LONG TERM		
	SITE	LOCAL	REGIONAL	SITE	LOCAL	REGIONAL
CULTURAL RESOURCES	●			●[2]		
Prehistoric Cultural Resources	○			○[2]		
American Indian Resources						
Historic Cultural Resources	●			●[2]		
PALEONTOLOGICAL RESOURCES	○			○[2]		

[1] Impacts are those generated by construction activities and having a long duration.

[2] Impacts are those generated by construction activities and having a long duration as well as those generated only by operational activities.

AGGREGATE MATRIX FOR CULTURAL AND PALEONTOLOGICAL RESOURCES

FIGURE NO. 3.5.2-1

importance of potential losses of historic properties within the Historic District/National Landmark; net beneficial effects also are assigned to the aggregate resource level because of the importance of the Historic District/National Landmark.

3.6 Mitigation Measures

In addition to the specific mitigation measures the Air Force will develop and implement as part of the Proposed Action (see Section 3.4.2), several general mitigation measures will be considered to treat potential indirect project impacts on lands outside Air Force jurisdiction and control (i.e., the Region of Influence, exclusive of the ACS).

The identification and mitigation of project-caused indirect impacts in the ROI will require the cooperative involvement of external federal, state, and local agencies having jurisdiction over such resources during system deployment and operation. These agencies are encouraged to:

- Strengthen or augment existing sanctions against inappropriate or destructive use of these resources; and
- Offer inducements to protect and enhance significant cultural and paleontological properties held in private or public hands.

Although in some instances implementation of these measures could require drafting and enactment of new legislation at the state or local level, to a large degree mitigation of adverse impacts from indirect project-induced causes can be accomplished within the existing statutory framework and would result in an overall lowering of impact levels in the ROI.

3.7 Unavoidable Adverse Impacts

Despite the best application of mitigation measures outlined in the preceding sections, unavoidable losses of important scientific or humanistic qualities may result from the Proposed Action. These include:

- Indirect impacts (e.g., vandalism, collection, fire, off-road vehicle damage) in the ROI from increased inmigration population levels during the construction and operational phases;
- Indirect impacts from increased onbase personnel required for operation of the Peacekeeper missile; and
- Direct impacts from construction-related disturbance of the existing land surface affecting resources that have escaped detection during inventory.

It should be stressed, however, that impacts of these kinds can be expected as a consequence of implementing any action involving disturbance of existing land surfaces in areas that contain cultural or paleontological resources.

Because of the large area included within the ROI and the relatively small numbers of projected inmigrants, unavoidable loss of scientific and humanistic values from indirect effects is not expected to be great, even on a cumulative

basis. The same holds true for the unavoidable direct impacts of construction operations. Implementation of an effective resources monitoring program during project construction will reduce the chances of disturbing potentially important cultural and paleontological resources in the ACS. In cases where such resources are encountered and avoidance is not feasible or practical, emergency data recovery efforts will be implemented in order to minimize adverse impacts.

3.8 Irreversible and Irretrievable Resource Commitments

Cultural and paleontological resources are fragile and nonrenewable, and disturbance of any kind will result in loss of data and/or material content that is irreversible and irretrievable. For example, archaeological sites that escape detection during the inventory phase may be lost, in whole or in part, despite the best emergency data recovery efforts.

At the same time, even in those instances where mitigation measures are implemented prior to construction activities, some degree of irreversible and irretrievable resource loss must be anticipated since recovery and recording techniques cannot hope to document resources in their entirety. For example, some kinds of information may not even be recognized as being artifactual in nature, and no specific mitigation measures can absolutely guarantee that important data will not be lost. Nevertheless, it is anticipated that such circumstances will have minimal adverse impacts to the existing resource base.

3.9 The Relationship Between Local Short-Term Use of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

Baseline-future conditions will result in the cumulative degradation of nonrenewable cultural and paleontological resources, but the process and resultant loss will be accelerated on a short and long-term basis by trenching, construction, and other ground-disturbing activities associated with the project in the ACS. Other resources, however, including some that otherwise might have been disturbed or destroyed by nonproject-related human or natural agencies, may benefit from the Proposed Action because they will be stabilized, protected, preserved, and maintained. This is particularly true of historic buildings at F.E. Warren AFB affected by the project. Even where some loss of resources is predicted (e.g., along onbase stage/transporter routes or buried cable paths), specific mitigation measures will obtain and preserve information and cultural materials that will contribute substantially to knowledge of regional culture history. It is anticipated that the number of cultural and paleontological resources lost without benefit of some form of mitigation will be small, and the resulting reduction of long-term productivity in the ROI will be slight.

GLOSSARY

4.0 GLOSSARY

4.1 Terms

Activity Area (Locus): an area within a site exhibiting evidence of specific human use or activity (e.g., a butchering area, a food processing location, a kitchen, a bedroom, etc.).

Advisory Council on Historic Preservation: nineteen-member body appointed in part by the President of the United States to advise the President and Congress and to coordinate the actions of federal agencies on matters relating to historic preservation, to comment on the effects of such actions on historic and archaeological cultural resources, and to perform other duties as required by law (P.L. 89-655; 16 U.S.C. 470, as amended).

Alluvial Fan: a fan-shaped sedimentary deposit composed of materials eroded from a mountain range and deposited by a drainage issuing from a canyon mouth.

Alluvium: sediments deposited by running water.

Altithermal: a post-glacial period of generally warmer than normal temperatures and less than average rainfall dating approximately from 7500 to 5000 years before present.

American Indian Cultural Resources: American Indian cultural resources consist of locations, structures, objects, and natural features of value to American Indians for traditional, religious, or ceremonial purposes. These resources include American Indian burials; contemporary sacred sites and areas; materials for production of sacred objects and traditional implements; and botanical, biological, and geological resources of ritual importance and their source locations.

American Indians: used in a collective sense to refer to all the peoples native to the North American continent, usually excluding Eskimos and Aleuts.

Anthropology: in a general sense, the scientific study of the human organism and its behavior.

Aquifer: the water-bearing portion of subsurface earth materials that presently yields or is capable of yielding useful quantities of water to wells.

Archaeology: a scientific approach to the study of human ecology, cultural history, and cultural process emphasizing systematic interpretation of material remains.

Archaic Period/Tradition: in the Great Plains, a period of time characterized by hunting and gathering subsistence patterns; by the development of barbed and stemmed projectile points for use on spears, grinding and milling stones for food preparation, and ground and polished stone tools for everyday use; and by the adoption of a seasonally migratory life style. Sites associated with this period usually date from 7500 to 1500 years before present.

Area of Concentrated Study: an area(s) within the Region of Influence which will receive the majority of environmental impacts. Environmental existing conditions and impact analyses are focused within the Area of Concentrated Study for this EPTR. The Area of Concentrated Study is defined for each environmental resource.

Artifact: anything that owes its shape, form, or placement to human activity. In archaeological studies generally, the term is applied to portable objects such as tools and to discrete nonportable items (features) such as housepits, fire hearths, cairns, buildings.

Artifact Predation: intentional or unintentional removal of an artifact or feature from an historic or prehistoric site.

Assemblage: the sum total of items produced by a particular culture within a limited period of time; also used to refer to a group of items produced by a particular technology (usually called an "industry").

Baseline: the characterization of an area under no-project conditions.

Biface: an artifact that has been worked on two surfaces at an intersecting edge.

Biota: all of the organisms of an area; the flora and fauna of a region.

Blade: a roughly parallel-sided, long, flat, and thin lithic artifact, usually sharp on one or both edges.

Breaks (noun): terrain characterized by abrupt changes in surface slope, e.g., a line of cliffs and associated spurs and small ravines.

Cache: a category of nonhabitation prehistoric sites presumably used for storage.

Cairn: a distinctly artificial pile of rocks that may mark or enclose burials as well as vision quests, caches, or geodetic locales.

Campsite: a habitation site exhibiting a weakly developed midden deposit.

Cenozoic: an era in geological history extending from the beginning of the Tertiary period, some 66 million years ago, to the present time and characterized by the rapid evolution of mammals, birds, grasses, shrubs, and higher flowering plants.

Ceramic Period: that period of time from approximately 1500 to 150 years before present in the central and western plains region characterized by the occurrence of ceramics; roughly corresponding to the Late Prehistoric period on the Northwestern Plains.

Ceramic Scatter: a spatially limited distribution of pot sherds on the surface of the ground.

Chronology: the science of arranging time in periods and ascertaining the dates and historical order of past events.

Climate: the prevalent or characteristic meteorological conditions, and their extremes, of any given location or region.

Complex: a group of related traits or characteristics that combine to form a complete activity, process, or culture unit. Lithic complexes are identified by the presence of several key implements or tool types in association.

Component: the manifestation of an archaeological focus at a specific site.

Contextual Data: data describing the physical and biological context in which artifacts are found (e.g., color of soil and species of pollen in a soil layer from which an artifact is recovered).

Corridor: a strip of land of various widths described on both sides of a particular linear facility such as a highway or transmission line.

Cretaceous: the last period of the Mesozoic era, extending between 144 and 65 million years ago.

Cultural Continuity: the retention or persistence of traditional roles, statuses, and identities through time in a specific cultural group, often occurring in spite of the addition of foreign language proficiency and the adoption of modern technological skills and innovations.

Cultural Resource: any building, site, district, structure, object, data, or other material important in history, architecture, archaeology, or culture studies.

Cultural Resources Evaluation: an intensive, on-the-ground survey and testing of an area sufficient to permit determination of the number and extent of the resources present, their scientific importance, and the time factors and cost of preservation, data recovery, or other mitigating actions reducing adverse effects.

Cultural Resources Inventory: see Cultural Resources Survey/Reconnaissance.

Cultural Resources Management: ongoing treatment of cultural resources utilizing mutually agreed-upon procedures to stabilize, protect, study, and preserve identified and expected cultural resources in a specified area.

Cultural Resources Site: a bounded geographic location showing evidence of past human activity.

Cultural Resources Survey/Reconnaissance: a literature search, records review, and on-the-ground surface examination of selected portions of an area to assess the general nature of resources present and the probable impacts of a project.

Cultural Sequence: an archaeologically distinct segment of a region's culture history.

Culture: broadly, the system of behavior, beliefs, institutions, and objects by which human beings relate to each other and to the environment.

Culture History: an aspect of archaeology in which archaeological data are organized to produce a historical sequence for an area. The culture historian seeks to determine the historical order and nature of cultural changes within a geographical area of study.

Cumulative Effects: the aggregation of project-induced effects within the project's Region of Influence. The term cumulative also has been used to denote aggregated effects over several years as against net effects in a given year.

Curation: the processes by which historically important artifacts, features, or structures are cared for and preserved.

Debitage: lithic debris produced in tool manufacture.

Detritus: a nondissolved product of disintegration or wearing away, usually used archaeologically to denote the waste flakes resulting from the manufacture of stone tools. It also can denote organic, perishable wastes or glass and metal debris.

Diagnostic Artifact: a sufficiently distinct feature or artifact type that can be placed into an existing cultural tradition.

Direct Effects: effects resulting solely from project implementation.

Dissected Terrain: a landscape dominated by gullies, arroyos, and valleys.

Dissected Topography: an area of land characterized by numerous valleys and gullies caused by extensive surface water runoff.

Disturbed Area: an area of the ground in which the surface has been affected or altered by human or natural agency.

Dry Croplands: croplands that receive their moisture from rainfall only, as opposed to irrigated croplands, which receive water from man-made irrigation systems. Dry croplands generally produce grain crops.

Ecology: the study of the interrelationships of organisms with and within their environment.

Ecosystem: a group of plants and animals, including their environment, arranged in a trophic structure and participating in energy flow and nutrient cycling.

Effect: a change in an attribute. Effects can be caused by a variety of events, including those that result from project attributes acting on the resource attribute (direct effect); those that do not result directly from the action or from the attributes of other resources acting on the attri-

bute being studied (indirect effect); those that result from attributes of other projects or other attributes that change due to other projects (cumulative effects); and those that result from natural causes (e.g., seasonal change).

Environment: the sum total or the resultant of all the external conditions which act upon an organism.

Ethnographic Research: the detailed, first-hand, systematic collection of facts about a contemporary social unit, usually a small-scale society or culture used to produce a descriptive case study.

Ethnography: the description of human groups and their behavior by direct observation and/or by transcription of statements by living persons.

Ethnohistory: history of nonliterate human groups consisting of oral literature or ethnographic records.

Ethnology: a branch of anthropology dealing with extant races and cultures ("peoples").

Fauna: animals; organisms of the animal kingdom of a given area taken collectively.

Flake: any piece of stone removed purposefully from a larger stone.

Flood Plain: that portion of a river valley subject to periodic flooding (high water).

Flora: plants; organisms of the plant kingdom taken collectively.

Focus: an archaeological unit, spatially limited to a locality or region, possessing traits sufficiently characteristic to be distinguished from all other such units.

Formation: a sequence of similar rock layers that can be traced over a large area.

Geochronology: that branch of geology specializing in the dating of specific geological events.

Geomorphology: that branch of geology specializing in the origin, development, and characteristics of surface features of the earth.

Habitation Site: a location bearing evidence of prehistoric human occupation (village or campsites) and distinguished by developed midden deposits.

Habitats: the places or physical areas with particular kinds of environments in which organisms live.

Hearth: a location used for the placement of fire which may be lined with clay or stones.

Heritage Values: properties or qualities of an historic or archaeological locality, object, feature, structure, or district that give it importance or that make it eligible for inclusion in the National Register of Historic Places.

Historic: a period of time after the advent of written history. In the Region of Influence, the historic period ranges from about AD 1800 to the present. It also refers to items primarily of Euro-American manufacture.

Historic Cultural Resources: consist of physical evidence of past cultural activity postdating the advent of written records in a given region. These resources may be archaeological, architectural, or archival in nature.

Historic District: delineated area formally designated as containing specific important cultural resources.

Holocene Epoch: the time since the end of the Pleistocene characterized by absence of large continental or Cordilleran ice sheets, extinction of large mammalian life forms, and rise of Homo sapiens. Generally considered to be the last 10,000 years.

Horizon (Cultural): an archaeological manifestation of a particular time period, often used to refer to an occupational period at a site or groups of related sites.

Horizon (Marker): a distinctive element that separates time periods. Cultural horizon markers usually are projectile point forms and ceramic types.

Humanistic Values: properties or qualities of an historic or archaeological locality, object, feature, structure, or district that are important because they have integrity and relate to architectural styles(s) or significant historic events, or are associated with historical personages, or are eligible for inclusion in the National Register of Historic Places because of these qualities.

Hydrogeologic Unit: one or more geologic units with similar waterbearing and transmitting characteristics.

Impact: an assessment of the meaning of changes in all attributes being studied for a given resource; an aggregation of all the adverse effects, usually measured using a qualitative and nominally subjective technique.

Indirect Effects: effects resulting from the attributes of other resources acting on the attribute being studied. For example, direct project employees will spend some of their income locally. As a result, local industries will tend to hire more workers as they expand in response to the increased demand. This additional employment is termed an "indirect effect".

Inmigrants: all people relocating into a defined geographic area usually calculated on an annual basis.

Intermittent Stream: a stream that does not have continuous flow during all periods of the year.

Isolated Artifact: an artifact or a small, disarticulated group of artifacts that cannot be associated with or that is situated outside of a cultural resource site.

Kill Site: an archaeological site indicated by the presence or association of faunal remains, butchering tools, and hunting equipment such as projectile points.

Lacustrine: pertaining to, produced by, or formed in a lake or lakes; growing in or inhabiting lakes. Characterized by lakes or lakebeds.

Land Use (Subsistence/Settlement Pattern): characteristic distributions of human activities throughout space and time that show the relationship between kinds of sites within the area used by a particular society.

Landowner: a person or entity indicated as the owner of property on the various ownership maps maintained by the Office of the County Assessor.

Lithic Debris: the waste material produced in the manufacture of stone tools; also, debitage and detritus.

Lithic Scatter: an archaeological site consisting only of lithic debris.

Lithic Waste Flakes: stone chips removed in the process of making stone artifacts.

Lithology: the physical character of a rock such as its color, hardness, mineral composition, and grain size.

Loam: a rich permeable soil composed of equal amounts of clay, silt, and sand, usually containing organic matter.

Long-Term Impact: direct or indirect effects occurring after project deployment as a consequence of project operations.

Megafauna: various species of large mammals that became extinct in North America sometime before 6000 years before present. These mammals include the mammoth, giant bison, camel, and giant sloth.

Memorandum of Agreement (Cultural Resources): a duly executed contractual document that constitutes the comments of the Advisory Council on Historic Preservation regarding a proposed federal action, that evidences consideration by the lead federal agency of the effects of its action on cultural resources within a project's Region of Influence, and that sets forth the rights and responsibilities of the signatories.

Mesic: pertaining to an environment having a moderate supply of moisture (e.g., a deciduous forest) and contrasting with xeric and hydric, referring to very dry (e.g., desert) and very wet or saturated environments (e.g., a bog), respectively.

Mesozoic: an era in geological history, ranging from about 245 to 66 million years ago, characterized by the development of reptiles.

Microenvironment: the environmental conditions actually experienced by an organism in its environment. Examples of microenvironments experiencing very different environmental conditions within the same locale would be a burrow, the area under a rock, a shaded surface, and a sunny surface.

Midden: soil horizon resulting from the accumulation of human living debris containing artifacts and cultural refuse such as bone and shell fragments, fire-cracked rocks, charcoal, chipping detritus, stone tools, or organic residues.

Miocene: an epoch of the Tertiary period, 24 to 5 million years ago, marked by the development of apes and appearance of ancestral gibbons.

Mitigations: methods to reduce or eliminate adverse project impacts. For example, project demand for local housing units could stress area housing markets; this impact could be reduced by project sponsors providing temporary housing for their employees.

National Landmark (Historic): a site, building, or object, in private or public ownership, possessing national significance in American History, archaeology, or culture. In order to achieve landmark status, a property must be, or have the clear potential to be, recognized, understood, and appreciated publically and professionally for the strength and clarity of its historical association, its architectural or design excellence, or its extraordinary information content on a national scale.

National Register: the National Register of Historic Places, which is a register of districts, sites, buildings, structures, and objects important in American history, architecture, archaeology, and culture, maintained by the Secretary of the Interior under authority of Section 2(b) of the Historic Sites Act of 1935 and Section 101(a)(1) of the National Historic Preservation Act of 1966.

Orogeny: the process of forming mountains, particularly by folding and thrusting.

Paleo-: prefix denoting "past" or "extinct."

Paleo-Indian: earliest documented hunting and gathering groups in North America, generally dating from 12,000 to 6000 years before present.

Paleontological Resources: fossilized organic remains from past geological periods.

Paleozoic: an era in geological history, occurring between 570 and 245 million years ago, marked by the culmination of almost all invertebrates except the insects, and in its later periods, by the first appearance of land plants, amphibians, and reptiles.

Pedestrian Reconnaissance: cultural resource survey conducted by personnel on foot (as opposed to those in a vehicle).

Perennial Stream: a stream that has continuous flow during all periods of the year.

Petroglyph: schematic or representational art incised or pecked into a stationary rock surface.

Phase: approximately equivalent to an archaeological focus but chronologically limited to a relatively brief time interval.

Physiographic Province: a region which has similar geologic structure and climate and consequently a unified geomorphic history.

Physiography: a description of the surface features of the earth.

Pictograph: schematic or representational art painted or drawn onto a stationary rock surface.

Plains Woodland Period/Tradition: that period of time in the plains region from approximately 1500 to 950 years before present marked by the appearance of pottery and the first attempts at cultivation of crops in an area that had previously been a region of hunting and gathering complexes.

Pleistocene: the last 1.6 million years of geological history, marked by repeated glaciation and the first indication of social life in human beings.

Pliocene: an epoch of the Tertiary period about 5 to 1.6 million years ago characterized by the development of the first man-like primates.

Precambrian: all geologic time before the beginning of the Paleozoic, equivalent to about 90 percent of geologic time.

Predictive Model: a statement or set of statements which attempt to define the conditions surrounding the occurrence of a certain class of phenomena. For example, an archaeologist might predict that prehistoric settlements occur at stream confluences.

Prehistoric: that period of time prior to the written record; in the Region of Influence, generally before AD 1800.

Prehistoric Cultural Resources: consist of those physical properties considered important to a culture, subculture, or community for scientific or humanistic reasons that predate the advent of written records in a particular geographic region. These include geographical districts, networks, structure, sites, objects, and other physical evidence of past human activity.

Prehistory: an archaeologically derived body of knowledge of past nonliterate human societies.

Preservation (Historic): the act of process of applying measures to sustain the existing form, integrity, and material of a building or structure, and the existing form and vegetative cover of a site. It may include initial stabilization work where necessary, as well as ongoing maintenance of the historic building materials or its environment.

Primary Impact: impacts due to direct influences from project activities.

Programmatic Memorandum of Agreement: a memorandum of agreement established to cover all phases of a complex or long-term proposed federal action or series of related actions, thereby obviating the need for a separate MOA for each individual phase or action.

Projectile Point: implement which probably served as the tip of darts, lances, spears, arrows, and other launched piercing tools (weapons).

Proto-history: that period in which nonliterate American Indian cultures were affected by Euro-Americans without direct contact. For instance, inland Indian tribes received trade goods and reports of European cultures from coastal tribes long before the arrival of European explorers in the interior.

Provenience Data: information about the location of artifacts.

Quantity Distance: the prescribed safety zone or required safe distance between places where explosives (including rocket propellents) are stored or processed, and other specified locations such as inhabited buildings, public traffic routes, recreational areas, utilities, petroleum storage facilities, and storage or processing facilities for other explosives.

Quarry (Cultural Resources): a locality at which lithic material was extracted and initially prepared for the manufacture of stone implements.

Quaternary: a geologic period including the Pleistocene and Holocene epochs; the last 1.6 million years.

Radiocarbon Dating: a method of dating carbon-bearing samples by analysis of radioactive carbon (C-14) content.

Rangeland: that land devoted to the grazing and keeping of animals such as cattle, sheep, and horses.

Region of Influence: the largest region which would be expected to receive measurable impacts from the Proposed Action.

Rehabilitation (Historic): the act or process of returning a property to a state of utility through repair or alteration that makes possible an efficient contemporary use while preserving those portions or features of the property that are significant to its historical, architectural, and cultural values.

Restoration (Historic): the act or process of accurately recovering the form and details of a property and its setting as it appeared at a particular period of time by means of the removal of later work or by the replacement of missing earlier work.

Riparian: pertaining to river and stream-side features, usually biological (e.g., riparian vegetation).

Riverine: living or situated on the banks of a river.

Rockshelter: naturally sheltered place exhibiting evidence of human occupation.

Rural: that area outside of towns, cities, or communities; characterized by very low density housing concentrations, agricultural land uses, and general lack of most public services.

Scientific Values: properties or qualities of any historic or archaeological locality, object, feature, structure, or district that are likely to contribute information important to prehistoric or historic research; they are one basis for determining eligibility for inclusion in the National Register.

Seasonality: phenomena that show cyclic or repeated behavior according to the season.

Section: a subdivision of a township that is 1 mile square.

Short-Term Impact: an adverse effect originating during the construction period up to 1990; such impacts may continue into the operational phase.

Shovel Testing: informal, limited subsurface testing, to minimal depths, of an area at predetermined intervals (e.g., grid intersects, 20 m apart, between larger test units).

Significance: the importance to the resource of the impact on the resource. Council of Environmental Quality (CEQ) regulations specify several tests to determine whether an action will significantly affect the quality of the human environment. While these tests apply to the entire action, they also can be used in an amended form to judge impact significance for individual resources. It is important to note that a high impact might not be significant, while a low impact may. Significance is an either/or determination: the level of impact described is significant or it is not significant. Additionally, beneficial significance must be determined at the same level as adverse significance. As specified in the CEQ regulations, significance needs to be determined for each of three geographic areas: local, regional, and national. This places the impact into context. Significance also is determined in terms of intensity.

Site Specific: conditions characteristic of a geographically defined location that may vary considerably from characteristics of adjacent locations or the characteristics of a larger area within which the location in question is contained.

State Historic Preservation Officer: the official within each state authorized by the state, at the request of the Secretary of the Interior, to act as liaison for purposes of implementing the National Historic Preservation Act.

Stratigraphy: natural, often differing, deposits that have accumulated in one place over a period of time and now lie layered beneath the earth's surface. Cultural materials are dated relative to each other by their position in stratigraphic layers.

Subsistence/Settlement Pattern: see land use.

Subsurface Testing: systemmatic methods and techniques for exploring, probing, or excavating limited, selected portions of a site for purposes of site evaluation.

Surface Collection: systemmatic mapping and removal of artifacts or features from a site by means not involving excavation.

Terrace: a flat portion of land created when a stream or river cuts further into its channel and migrates laterally to a different location.

Tertiary: the first period of the Cenozoic era extending between 66 and 1.6 million years ago.

Tipi Ring/Stone Circle: a circle of stones generally measuring from 3.5 m to 7 m in diameter that is thought to represent the remains of various types of structures, or to have served a religious or ceremonial function.

Tool: a portable artifact exhibiting evidence of use. Common examples are projectile points, knives, etc.

Township: a 36 square mile surveyed tract of land identified relative to its relationship to defined parallels of latitude.

Tradition: a configuration of cultural traits having long temporal duration and limited spatial extent.

Unavoidable Adverse Impact: a project-induced effect determined to be adverse that cannot, or will not, be mitigated or avoided.

Urban: that area within towns, cities, or communities, characterized by densities greater than one dwelling unit per acre.

Weighting Factors: numerical weights, determined by judgment, used to increase or decrease the relative score of a particular impact category. The use of such factors is designed to emphasize important or sensitive issues in grading of impacts and ranking of sites.

Windshield Survey: reconnaissance technique in which vehicles are the primary means of examining the study area and identifying cultural (usually historic structures) resources; as opposed to pedestrian reconnaissance.

Years Before Present (BP): dating terminology establishing the age of an object, material, structure, or burial in terms of the number of years prior to AD 1950.

4.2 Acronyms

ACS	Area of Concentrated Study
ACHP	Advisory Council on Historic Preservation
AFB	Air Force Base
AFRCE-BMS	Air Force Regional Civil Engineer - Ballistic Missile Support
AIRFA	American Indian Religious Freedom Act
BLM	Bureau of Land Management
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CRMP	Comprehensive Resource Management Plan
DA	Deployment Area
DAR	Defense Access Road
EPTR	Environmental Planning Technical Report
FCR	Fire-Cracked Rock
FEIS	Final Environmental Impact Statement
GLO	General Land Office
LCF	Launch Control Facility
LF	Launch Facility
LOI	Level of Impact
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NRHP	National Register of Historic Places
OB	Operating Base
ORV	Off-Road Vehicle
PL	Public Law
PMOA	Programmatic Memorandum of Agreement
QD	Quantity Distance
ROI	Region of Influence
SCS	Soil Conservation Service
SHPO	State Historic Preservation Officer
SMS	Strategic Missile Squadron
SSA	Stage Storage Area
S/T	Stage Transporter
USAF	United States Air Force
USC	United States Code
USDA	United States Department of Agriculture
WSA	Weapons Storage Area

4.3 Units of Measurement

AD	anno Domini
BP	before present (years/1950 base)
^{o}C	degrees Celsius
ca	circa (approximately)
cm	centimeter
cfs	cubic feet per second
^{o}F	degrees Fahrenheit
ft	foot or feet
ft/mi	feet per mile
gal	gallon
km_2	kilometer
km^2	square kilometer
kWh	kilowatt hour
m_2	meter
m^2	square meter
m/km	meters per kilometer
mi	mile
pH	measure of hydrogen ion concentration; measure of acidity or alkalinity
sq ft	square foot or feet
sq mi	square mile

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